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NATIONAL PROBLEMS OF CANADA

The Alberta Coal Problem

By H. L. DRAPER

Published by the Packet-Times Press, Limited, Orillia, for the Department of Economics and Political Science, McGill University, Montreal

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By HERBERT LEIGHTON DRAPER

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FOREWORD

In the early post-war years when reconstruction problems were being attacked vigorously by economists and statesmen the world over, many problems of national importance presented themselves for solution. The mighty upheaval in Europe had called fourth every ounce of strength on the part of its participants. It had stimulated certain industries far beyond the point that would have been reached in many years of peace-time development. It broke down existing channels of trade and commerce. It developed new channels where none before existed.

With the cessation of hostilities many of the war-stimulated industries collapsed entirely. Others suffered a period of stagnation, from which they have not yet fully recovered. Not the least of these is the coal industry of the world.

The solution of the international problems presented in that industry is a subject of study by no less a body than the International Labour Organization of the League of Nations. Nearly every coal producing nation is grappling with those problems from a national standpoint. They are endeavouring to recover old markets, or provide new ones for the product of their coal mines. On the solution of the problems depends the prosperity of their mining communities, and in the case of industrial nations, the prosperity of their entire industrial system. The resulting "Coal War" which has raged incessantly since the beginning of the present decade, is well-nigh as relentless as the forces of competition, growing out of over-developed industry and consequent over-production, can make it.

In Canada the situation took on not so much the aspect of over-production, as it did in other countries, but rather the aspect of nationalization—the attempt to render the whole country independent of any foreign source of supply, especially as regards fuel for heating purposes. It was, and still is, an attempt to divert a part of the coal trade from natural economic channels, and to confine it, by artificial means, within the political boundaries of the Dominion.

The aim of the writer is to endeavour to differentiate clearly the many conflicting phases of the Canadian question. If, by plainly exhibiting the facts, the major, controlling, economic considerations are distinguished from the petty arguments of political propagandists, and if the futility of attempting to force trade into unnatural channels is in the least degree demonstrated, then, it is the hope of the author that this monograph will serve a purpose.

CHAPTER I.

THE COAL RESOURCES OF CANADA

THE importance of the subject, "Alberta Coal" is self-evident if it be remembered that this western prairie province possesses, within its boundaries, about one-seventh of the known coal resources of the world. In any examination, therefore, of the utility of that coal to Canada at the present time, it is necessary first to obtain a proper perspective of the resources of that province in relation to those of the Dominion as a whole.

It has been estimated that the coal resources of this country amount to about 71.38 per cent. of those of the British Empire[1]. Since the Empire has about 25 per cent. of the available coal supplies of the world, it follows that Canada must have between 17 and 18 per cent., or roughly, one-sixth of the world's supply. These immense reserves vary in quality from the brown lignites, which are of little commercial value beyond the particular localities in which they are mined, to semi-anthracitic coals which compare favourably in heating efficiency with the best of that obtainable in Pennsylvania.

A general classification of coals, which will be necessary to the ready understanding of some of the tables and statistical work in this monograph, follows:[2]

A1 Anthracite
A2 Semi-anthracite
B1 Anthracitic coal and high carbon bituminous coal
B2 Bituminous coal
B3 Low carbon bituminous coal
C. Cannel coal
D1 Lignitic or sub-bituminous coal
D2 Lignite

In 1913, Canada's actual reserve of coal was estimated

1 Coal resources of the World, 1913.
2 Canada Department of Mines, Geological Survey, Memoir 59, P. VIII.

to be 414,804,193,000 metric tons[3]. In addition to this there were probable reserves estimated at over eight hundred billion tons[4]. From the first figure must be subtracted the comparatively insignificant amount of 223,597,691 tons[5], the total amount extracted since that year. The resulting quantity of over 414.5 billion tons of actual reserves, as yet untouched, is entirely beyond human visualization. Nevertheless it represents only about one-third of the total of Canada's estimated resources of coal.

Nova Scotia[6]

The coal measures of Nova Scotia are largely confined to five districts or areas known respectively by the names of the counties in which they are found. Thus the Cumberland field is situated near the isthmus of Chignecto and on the eastern shores of Chignecto Bay. The Pictou coal-field in Pictou County is situated on the shore of the Strait of Northumberland almost directly south of the eastern end of Prince Edward Island. The Inverness fields on the western side of Cape Breton Island and the Richmond area, extending eastward from the eastern end of the Strait of Canso, form the two minor fields of Cape Breton. The Sydney coalfields in the north-eastern section are probably the most extensive in the province.

The total area covered by these five great coalfields not including the marine areas contiguous to the Sydney and Inverness districts is 173.41 square miles. That includes seams of coal of one or more feet in thickness to a depth of 4000 feet. By calculations based on actual thickness and known extent the grand total of Nova Scotia's resources was estimated to be 2,248,151,000 metric tons. From that, 155,108,903 (60,000,000 tons mined previous to 1913 and 95,108,903 tons mined since that year) must be deducted. The resulting figure of 2,093,042,097 metric tons represents the unmined coal of Nova Scotia after mining operations have been carried on for a period of more than a hundred and forty years.

By far the greater proportion (98 per cent.) of Nova Scotia's coal is a good grade bituminous fuel. The remaining two per cent. is cannel-coal, a class which produces an

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3 A metric ton equals 2,205 pounds avoirdupois, approximately.
4 Vide Appendix A.
5 Canada Year Book, 1927-28, p. 382.
6 Canada Department of Mines, Geological Survey, Memoir 59, P. 8.

exceptional amount of gas. One of the chief features of the Nova Scotia coal-fields is the remarkable thickness of the seams. In the Pictou fields, for example, the seams vary from four to eighteen feet in thickness[7], a feature which tends to make many of the mines readily workable.

New Brunswick[8]

New Brunswick is not as fortunate as her sister province in the matter of extensive coal measures. Until the present time there has been only one workable coal field discovered. It is situated in Queen's County and is known as the Grand Lake coal-field. In most sections of the field the seams are thin, being nowhere in excess of two feet. The measures cover a territory estimated at slightly over a hundred square miles. In that area there is a probable reserve of about 138 million metric tons, all of which is thought to be of the bituminous class.

Prince Edward Island, Quebec and Ontario [9]

Prince Edward Island and Quebec are not known to have any coal deposits. Ontario is in practically the same circumstances, having an area of coal measures of only about ten square miles. The measures contain, at a maximum estimate, not more than 25 million tons of lignite.

The area is situated north of the height of land between Lake Superior and Hudson Bay and is almost directly north of the town of Cochrane on the Canadian National Railway. The coal, being entirely lignitic in quality is of little commercial value and will continue to be so until there is a local market within a few miles of the field.

Manitoba [10]

Manitoba, like Ontario, has very little coal. A lignite, or brown coal-field which covers an area of not more than fifty square miles is found on the western slope of a hill called Turtle Mountain. It is in the extreme south-western corner of the province. The available coal in that field has been estimated at 160 million tons. The field is notable not because of its size, nor because of the quality of the fuel found there, but because it seems to form the eastern outpost of that immense area, underlain with coal and lignites, which stretches from

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7 Ibid. p. 23.
8 Ibid. p. 56 et seq.
9 Ibid. p. 63 et seq.
10 Ibid.

the south-eastern corner of Saskatchewan, westward to the Rocky Mountains, and north-westward to Edmonton and the Peace River country.

Saskatchewan [11]

The whole southern portion of Saskatchewan from Manitoba to Alberta is underlain with coal-bearing formations. All measures in that province contain lignites, or lignitic coals. The Souris River Valley in the south-eastern section of the province is the scene of fairly extensive mining operations. The towns of Bienfait and Estevan are the principal centres at which the industry is conducted at present.

The total areas known to contain deposits exceed 300 square miles, in which there is estimated to be 2412 million tons of brown lignite. In addition to this actual reserve, large areas on the eastern side of the Alberta-Saskatchewan boundary extend northward from the Cypress Hills, through Maple Creek, a town on the Canadian Pacific Railway, to Unity and probably Kerrobert. These areas are thought to be underlain with coals of the Belly River formation of eastern Alberta. Natural exposures, and information derived from several borings have substantiated the theory. Thus there is now believed to be an area of approximately 13,000 square miles, containing at least 57,400 million tons of lignite and sub-bituminous coal.

Alberta [12]

Of all the provinces of Canada, Alberta has, by far, the greatest coal resources. Estimated at 85 per cent. of the total deposits of the Dominion, Alberta has about 14½ per cent. of the coal resources of the world. Almost the whole of the southern part of the province is underlain with coal which varies in quality from the lignites and lignitic coals of the Edmonton formation to the low carbon bituminous coals of the Belly River formation and the bituminous and anthracitic coals of the Kootenay formation.

Of the last mentioned, there are only about sixty-five square miles containing an amount of coal estimated at 2695 million metric tons. The Belly River formation, not having been developed to any extent, is still in the "probable reserves" class. The Edmonton horizon, and with it are included what

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11 Ibid. p. 65 et seq.
12 Ibid. p. 72 et seq.

are known as the lower Paskapoo beds, covers a tract of over 25,000 square miles, in which there are some 283,697 million tons of coal.

In addition to these general estimates of districts known to be underlain, there are also those vast areas, which, geologists assert, are likely to contain coals and lignites of various qualities, and which connect with the known areas. The probable reserves which include the Belly River formation mentioned above, are estimated at 56,375 square miles in extent and contain roughly about 673,554 million tons.

So vast is the region, and unparalleled, in Canada at least, the coal reserves of Alberta, that it is difficult to comprehend the importance of that mineral, as a form of wealth, to the province. When it is considered that the coal-fields are little less than bounded by the boundaries of the province itself in the southern part; and that these fields extend north-westward to the upper reaches of the Peace and Athabaska rivers, then can one begin to realize the significance of Alberta's enormous supply of coal.

British Columbia [14]

The coal-fields of British Columbia are very small as compared with those of Alberta, but have the advantage, on the other hand, of containing, on the whole, a better quality of coal. Good grades of bituminous and anthracitic coals with little, if any, lignite are characteristic of all of the British Columbia areas.

The Crowsnest Pass areas contain coal of essentially the same quality as that in adjacent Frank and Blairmore fields in Alberta. A good quality bituminous coking coal is mined in very close proximity to the Canadian Pacific Railway. The known areas in the southern and south-eastern parts of the province aggregate 230 square miles. An additional 216 square miles of probable reserves are estimated. Both together contain some 34,873 million tons.

In the central interior there are various small fields such as the Morice, Bear and Skeena River areas, and in the northern part of the province such fields as those on the Peace and Liard Rivers contain probable reserves estimated at 5,140 square miles.

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14 Canada Department of Mines, Geological Survey, Memoir 59, P. 104 et seq.

On Vancouver Island are situated several large deposits of bituminous coal, chiefly at Nanaimo, Cosmox and Suquash. Of the actual reserves there is a known area of 185 square miles in which there is estimated to be 1,178 million tons, together with a probable reserve of 6,369 million tons contained in a district covering an additional 645 square miles. Farther north, on the Queen Charlotte Islands, about 69 million tons of excellent bituminous coal are contained in a field of 24 square miles, with probable reserves covering nearly three times as great an area.

Yukon, North West Territories and the Arctic Islands [15]

The Yukon also has its share of coal. The qualities are about the same as those found in British Columbia. The probable area containing this mineral is about 2,840 square miles in which there is estimated to be over 4,940 million tons. Lying to the east of the Yukon, in the North West Territories in the vicinity of Fort Norman and at the Mackenzie River delta, are, as revealed by the explorations of V. Stefansson in 1910-11, known areas of lignitic coal. These have been little explored, but the estimated coal in one field alone, that around Fort Norman, is 4,800 million tons.

Owing to the efforts of many search parties that were sent out to search for the Franklin exploration party, several of the northern islands are known to have coal deposits, samples of which have been brought from the Arctic from time to time. They have proven to be fairly good specimens of bituminous and cannel-coal. Banks Land, Melville Island, Bathurst Island and North Devon Island are the principal coal bearing areas and the estimate covering the whole group is that they have about 6,000 million tons.

Such, in a general way, are the coal resources of Canada[16]. Stupendous as they are—entirely beyond the power of visualization—Canada has, nevertheless, an acute fuel problem. The story of the development of that seemingly paradoxical situation, and an examination of the possibilities of utilizing western coal to solve the problem on an economically sound basis is the subject of this monograph.

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[15] Ibid. p. 147 et seq.
[16] Vide map 125A, Geological Survey, Memoir 59.

CHAPTER II.

THE CANADIAN COAL MARKET

I.

Magnitude

During the period from 1867 to 1927 the increase in the consumption of coal in Canada was phenomenal. In that era of sixty years the population of the country increased from 3,689,257 (1871 census) to 8,788,483 (1921 census)[1]. In the same period the coal consumption increased from an annual average of 1,508,574 tons between the years 1872-79 to 31,005,-479 tons, annual average, between the years 1917 and 1926[2]. Thus, while the population scarcely tripled during the sixty years, the annual consumption of coal grew until it is now nearly twenty times as great as it was during the early years of Confederation.

The great difference between the relative increase of population and the consumption of this basic commodity can be explained partially at least by the gradual disappearance of the wood-lot in the rural communities of Eastern Canada, and partially by the very great increase in population on the prairies where every new immigrant meant an increase in the annual coal consumption in the country. No figures are available which show the relative amounts of fuel used for household purposes as distinguished from that used in industries, during the early years of that period, hence it is impossible to make any definite comparison. It is evident, however, that the great disparity between the two rates of increase cannot be wholly explained by the methods suggested above. By far the greater amount of that difference must be ascribed to the growth of coal using industries, especially the railways, which now use more than one-third of the bituminous coal used in Canada.

With the exception of the last decennial period, the coal consumption doubled, approximately, in each succeeding decade since 1867[3]. Thus the average annual consumption

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1 Canada Year Book 1927-28, p. 101.
2 Appendix C, also fig. 1.
3 Ibid.

for these periods, starting with 1.5 increased in millions of tons as follows: 3.0, 5.4, 11.6, 25.5 and 31.0. The reason for the comparatively small increase in the last instance can be traced to several factors, the most important of which are, firstly, the increased use of oil and gas as heat and steam producing media; secondly, the enormous growth of hydro-electric power; and thirdly, the natural retrenchment and stabilization in industrial activity which follows upheavals like that occasioned by the Great War.

In support of the first it may be noted that the amount of oil apparently used for fuel in 1926 was 287,000,000 imperial gallons. That amount of oil would displace approximately 2,050,000 tons of coal[4]. In 1925 it comprised, in order of value, 12.6 per cent. of Canada's industrial fuel[5]. The second statement is attested by the fact that in 1918 there were only 663 electric light and power companies registered in Canada, while in 1927 the number had more than doubled, there being a total of 1563 stations[6]. It is estimated that at six tons per installed horsepower, "the coal equivalent of the full capacity waterpower now developed in Canada would be in excess of 27,000,000 tons per annum."[7] The third statement, although not easily proven, is shown to be well within the range of possibility when it is noted that, although the total number of manufacturing establishments of all kinds increased from 19,218 in 1910 to 23,249 in 1919, the number had decreased to 22,331 in 1925[8].

The consumption of coal within a country can be calculated approximately by the amount produced, plus any importation from foreign sources and less any exports. A survey of the figures respecting the two sources of supply[9] shows that not until the decade 1908-17 did the importation figures exceed the domestic production. The supply from the Two sources grew quite consistently on the whole. The exports were, of course, small in comparison with the amounts produced and imported. In the past six decades they grew from an annual average of 334,481 tons in the first to 1,612,656 tons in the last[10].

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4 Dominion Fuel Board. Second Progress Report 1923-28, p. 23. Computed from figures given therein.
5 Canada Year Book, 1927-28, p. 454.
6 Ibid. p. 394.
7 Dominion Fuel Board. Second Progress Report 1923-28. p. 28.
8 Canada Year Book 1927-28. p. 407-9.
9 Vide Appendixes D and E; also figure 1.
10 Vide Appendix F.

A slightly more detailed survey of the period from 1912 to the present time reveals some interesting facts. In that year the importation figures exceeded the domestic production for the first time[11]. During the war years and as late as 1925 there was great variation, but on only two occasions; viz., 1916 and 1923, were the relative positions interchanged. From 1924 to 1927 there was a decided tendency toward equality, the difference in the last year amounting to only a few hundred thousand tons.

A further fact may be noted. The great variations in the total importations during the period were the results of variations in the imports of bituminous and not anthracite coal. The former varied between a low mark of 9.1 million tons in 1915 and a high mark of 16.55 million tons in 1919, whereas the anthracite imports varied not more than two million tons during the period, and in the first ten years the variation was within one million tons.

The exportation of coal since 1912 showed little variation, the annual figures approximating as they did, two million tons. Since 1923 there has been a fluctuating but persistent decline until, in 1927, only about one half of that amount went to foreign markets.

Great as were the changes in annual consumption, production and importation since 1867, the greatest change was within the province of Alberta itself. At Confederation very little was known of the coal resources within the boundaries of the then constituted North West Territories. Certainly no mining was done. The early seventies saw the beginnings of western development. The early eighties brought the railways, which at once provided a market in themselves and afforded transportation facilities to other markets. Production was limited, however, as is witnessed by the fact that between 1900 and 1907 the total quantity extracted in Alberta was less than six million tons. That output has steadily increased until in 1927 the high peak of 6,929,366 tons was reached. Of the total production in Canada for that year the Alberta output represented 39.79 per cent. Of the total amount consumed in Canada in that year the coal extracted in Alberta represented only 20.6 per cent. Furthermore, that output was only 39.67 per cent. of the amount of coal imported.

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11 Vide Canada Year Book 1926-27 for the actual figures for that and the immediately preceding years.

With the vast wealth of coal resources in Alberta yielding less than two-fifths of the amount that is annually imported into Canada, it is obvious that there is a great controlling factor entering into the question. Despite the many millions of tons of coal available in Nova Scotia and New Brunswick; despite the far greater reserves of the prairie provinces of Saskatchewan and Alberta, Ontario, and to some extent Quebec, the two leading industrial and most populous provinces of the Dominion, found that, owing to the much shorter distance, it was economically more advantageous to import all supplies of fuel, both household and industrial, from the Pennsylvania coal-fields.

Of all the bituminous coal imports from the United States to Canada, Central Ontario consumes more than 75 per cent. Quebec, chiefly the Montreal district, uses another 10 per cent. Likewise, of the total anthracite imports, Ontario takes about 65 per cent. and Quebec 30 per cent. In any consideration of the possibilities of supplanting this vast importation into the Central Canadian market, especially the imports of household fuel, namely anthracite, with fuel produced in Canada, one of the first questions that will arise is: "How do Canadian coals, and particularly those of the west, compare with the imported commodity."

II.
Physical Properties of the Competing Coals

Apart from all monetary considerations such as cost at the mine, cost of transportation, handling charges and dealers' profits, there are certain natural phenomena, concerning coals of various classes, which necessarily must be examined. These phenomena determine the suitability of the various coals for various purposes, and thus have a marked effect on the marketability of the different classes. Such things as friability, weathering properties and chemical constituents, which in themselves make fuels attractive, or the reverse, in any market, are here considered.

A. Friability and Weathering Properties

Friability is the tendency of any solid substance to break up into smaller particles when subjected to handling. The term "weathering properties" of coal refers to the degree of resistance to disintegration owing to exposure to atmospheric conditions. These two characteristics are, in coal, scarcely separable because, in the case of nearly every grade, weather-

ing has to a lesser or greater extent, depending on the class of coal, the effect of rendering all coals more friable. For this reason both characteristics will be discussed in this section.

In tests which have been recently made by the Department of Mines of Canada[12], certain outstanding facts have been recorded regarding the coal of Alberta as compared with samples from other sources. The results of a three hour tumbling test, performed by that Department, on each of the several different grades of unweathered coals from various mining districts, are herewith appended[13].

A careful study of that table will show that in the semi-bituminous class, which is commercially known as "smokeless" or "low-volatile" bituminous, the two samples tested (items 9 and 10) showed a greater degree of friability than any of the other classes. Tumbling produced a large amount of "smalls" and an abnormal quantity of "fines.' (The technical difference in terms is explained at the beginning of the table). Of those two samples the Fuel Testing Station report revealed for the Alberta coal a 14.1 per cent. greater amount of lumps at the completion of the experiment than was shown for the similar sample from the United States. That percentage was balanced by a lesser amount of "smalls," "fines" and "dust" in the proportion of 3.1 per cent., 9.4 per cent. and 1.6 per cent. respectively. Thus it would seem that unweathered semi-bituminous coal from Alberta can be handled with much less breakage resulting than can the same class of fuel from the Pennsylvania field.

In the bituminous class there are no reports of any tests made on Alberta coal. It appeared from the results obtained from testing samples from other localities that bituminous may be considered as being less friable than semi-bituminous coals. Those Alberta fuels in the sub-bituminous category compared favourably with the bituminous of other districts, especially as regards the large lumps remaining unbroken. It will be noted that there was a tendency toward the production of a greater quantity of "smalls" than resulted from the tests on Pennsylvania bituminous, but the amount of "fines" was decidedly less.

In the tests on unweathered lignites, for which there

12 Canada Department of Mines. Summary Reports 1923, 1924, "Fuels and Fuel Testing."
13 Appendix G.

were no comparative tests on coals of a like character from other sources, the results, despite a wide variation among the individual samples, showed that the class as a whole was much less friable than the bituminous coals. In many cases, in fact, they compared favorably with some of the best Pennsylvania anthracites, the results of the tests on which are not shown in the table accompanying this work[14]. More "fines" were produced than from the bituminous or sub-bituminous classes.

In the same group of experiments tests were made on the same classes of coal after they had been weathered for periods ranging from four and a half to twenty months[15]. Some were weathered in "open-sheds," i.e., were protected from direct contact with rain or snow, and from the drying effect of direct sunshine, while other samples of those coals were weathered entirely in the open air and were thus subjected to all the ordinary meteorological phenomena.

(a) Open-shed exposure (Under cover)

The Pennsylvania bituminous coals were little affected by open-shed exposure. The report states as follows: "All through the test these coals were remarkable for the small changes of friability which they exhibited under varying conditions."[16] The general conclusion reached by the investigators was, that as a class, bituminous coals would be little affected by open-shed exposure. The sub-bituminous coals also proved that they would be good storage coals if kept under cover. The effect of the open-shed exposure was not great, the increased friability being most noticeable in the greater quantity of "fines" produced by the subsequent tumbling tests.

Respecting the lignites it was stated that they showed increased friability after only four months' exposure[17]. The marked increase in the quantity of "smalls" and "fines" lead to the conclusion that lignites of all grades are not good storage coals, and that in order to be of the greatest utility as regards size, should be used soon after being mined.

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14 Vide Canada Mines Summary Report 1924 "Investigation of Fuels and Fuel Testing" p. 32 for complete statistical results of all tests.
15 Ibid. pp. 33-35.
16 Ibid. p. 26.
17 Ibid.

(b) Outdoor Exposure

In view of the conclusions drawn from the results of the tests in open-shed weathering, it is not surprising that the results of the tests on all classes of coal subjected to outdoor exposure showed a great increase in friability. There again the Pennsylvania bituminous coals showed their comparative resistance to breakage, while the anthracites broke up considerably more than in the other tests. The lignites had crumbled greatly, even before being subjected to tumbling, showing conclusively the direct effects of the exposure. Of the large, Drumheller lumps, 34 per cent. passed through a half-inch screen after open-air exposure. That, as well as the larger sizes, when subjected to the regular tumbling tests resulted in the production of an abnormal quantity of "smalls."

From the standpoint of friability of unweathered and weathered fuels those tests at the official fuel testing station at Ottawa established several interesting facts:

1. That unweathered, semi-bituminous, Alberta coals compare very favourably with similar coal from other sources.

2. That unweathered, sub-bituminous, Alberta coal is scarcely more friable than Pennsylvania bituminous; and less so than that from New Brunswick.

3. That freshly-mined, Alberta lignites are but little more friable than anthracite.

4. That the higher grades (sub-bituminous) of Alberta Domestic Coals are fair storage coals if protected from rain, snow and sunshine.

5. That Alberta coals as well as those from other sources show a decided tendency to disintegrate after long periods of open-air exposure.

The results of those experiments served to corroborate the evidence given before the Select Standing Committee on Mines and Minerals, 1923, by the Trade Commissioner of the province of Alberta, who testified as follows:[18]

Q. You would not want it (Domestic Coal) exposed to rain?

A. No, it should be under reasonable cover. As long as it is away from rain and out of the hot sun, you are not going to see much disintegration.

Q. How, in your opinion, would this kind of coal, put

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18 Appendix No. 6. Journals of the House of Commons 1923. p. 91 Evidence: H. Stutchbury.

into the cellars of householders in the city of Toronto or the city of Ottawa, stand storage ?

A. It would stand storage indefinitely.

It should be noted, however, that the tests revealed that the storage properties applied only to the sub-bituminous coals and not the lignites. Both classes are generally included in the general term "Domestic Coal" as applied to that fuel from Alberta which is suitable for household use.

B. Chemical Constituents

It is the chemical properties of any fuel that determine its suitability for various purposes. One class of coal is excellent for the production of household coke; another for metallurgical coke. One class is excellent for steam producing purposes, while another may not be particularly suitable for that, but its utility may be greatest in the production of gas. One, owing to its low ash content, smokelessness, or freedom from clinkering or coking may prove to be a fine household fuel whereas if used for some of the other purposes would be found to be partially or wholly inadequate. All of these conditions with respect to the various coals, are directly traceable to the chemical composition of each. It is not within the scope of this study to give a chemical analysis of various coals—that is the work of the chemist—but a summary of certain outstanding facts relating to Alberta's product is essential.

One of the best coals for steam producing purposes is a Welsh coal known as "Nixon's Navigation." It is taken as the standard of comparison in most experiments, but owing to the fact that it is little known to Canadian consumers the index or comparative heating efficiency, as given for the various coals in the tables which follow is not based on comparisons with it. The comparisons are made with a West Virginian coal from the Georges Creek mining area. The latter coal has an index number of only 83.8 relatively to the Welsh fuel mentioned. The tests, the results of which are given here, treat more specifically of comparative steam and heat producing efficiency, as have been determined from time to time by official tests.

In general a high fixed carbon content combines with a low volatile content to form anthracite. These elements gradually interchange in ratio in the lower classes until in

the lignites the volatile matter forms over 30 per cent. of their bulk. In hard, dry anthracite the fixed carbon content is usually over 80 per cent. and the volatile matter below 6 per cent. In semi-anthracite the fixed carbon is between 75 and 85 per cent. and the volatile matter below 10 per cent. In semi-bituminous the fixed carbon is from 65 to 75 per cent. and the volatile matter from 12 to 18 per cent. In the bituminous, sub-bituminous, and black and brown lignites the fixed carbon varies greatly, ranging as it does, from nearly 60 per cent. in the former down to 40 per cent. in the lower grades of the latter. The volatile matter in all of these classes varies from 28 to 35 per cent.[19]

The following table shows the chemical analyses of various grades and classes of fuel, and gives a basis on which to judge the value of the Alberta commodity[20].

The table does not give the fixed carbon content, but since the "fuel ratio" is the result of dividing the percentage of fixed carbon by the percentage of volatile matter in the sample, the fixed carbon content may be easily determined by multiplying the percentage of volatile matter by the fuel ratio as given.

FUEL	% Moisture	% Ash	% Vol. matter	Fuel Ratio
Pennsylvania Anthracite	3.8	12.9	6.3	12.15
Welsh Anthracite	2.7	6.2	7.0	12.03
Semet Solvay By Product Coke (Hamilton)	0.8	8.6	1.6	55.6
" " " " " (Dunbar, Pa.)	0.4	13.6	0.8	99.2
Pennsylvania semi-bituminous	1.2	8.7	19.6	3.6
Alberta semi-bituminous	1.0	13.0	15.8	4.45
Pennsylvania bituminous	1.5	6.2	34.7	1.65
New Brunswick bituminous	0.9	8.9	34.8	1.60
Alberta sub-bituminous (Coalspur)	8.9	9.2	34.6	1.35
Alberta sub-bituminous (Saunders)	9.5	7.8	32.3	1.55
Alberta lignite (Drumheller)	19.3	7.6	29.9	1.45
Saskatchewan lignite (Estevan)	18.2	10.8	31.1	1.30

From the above it is quite evident that the lower the class of fuel, the higher is the water content and, until a certain point is reached, the higher the amount of volatile matter. The ash content, on the other hand, varies very little, some of the best grades of anthracite having as high a per-

19 Note: This grading is based on the results as shown in the accompanying table. For a slightly different classification see "Mechanical Engineer's Pocket Book, 1904, p. 624.

20 Vide Canada Department of Mines, Summary Report, 1924, "Fuels and Fuel Testing," p. 29-30 for complete statistical information.

centage as do the lignites. The fuel ratio, depending as it does on the quantities of fixed carbon and volatile matter, gradually decreases from about 12 in the anthracites to less than 3 in those classes below the semi-bituminous group. The reason for the exceptionally high ratios in the case of the cokes is, of course, accounted for by the fact that in the process of coking nearly the whole of the volatile matter is driven off in the form of gas, coal-tar and other by-products. The fixed carbon content of coke, therefore, is generally greater than that of the best anthracite coal.

In the practical tests the following data was given regarding the steam producing efficiency.

Table to show evaporation with Alberta Semi-Anthracite Coals.

Description	Calorific value per pound as fired	Moisture in coal as fired	Ash and clinker in dry coal %	Index No.	Equiv. Evap. per lb as fired
No. 1 mine, W. H. McNeil Co., Canmore	13100	0.8	15.6	90.6	7.74
No. 1 mine, W. H. McNeil Co., Canmore (washed)	13780	4.3	8.9	98.5	8.44
Mixed coal—Bankhead Colliery Bankhead Mines Ltd.	13000	0.6	15.6	84.4	7.30
Mixed coal—Bankhead Colliery Bankhead Mines Ltd., (washed)	13500	2.7	9.5	94.4	8.2
Briquettes from Bankhead Colliery	13010	.7	15.2	84.5	7.27

The calorific value of the best anthracite coals available seldom exceeds 15,500 B.T.U.'s[21] per pound. In the official ratio the Georges Creek coal averaged about 13,500, hence from the information given in the table the Alberta anthracitic coals have a comparatively high ratio. The efficiency, as shown in the fifth column averaged slightly above 90 per cent. The report stated that, generally speaking the coals showed little if any smoke, no flame, and very little clinker, none of which gave any trouble. The boiler efficiency was rated as good. With these characteristics, therefore, the Alberta semi-bituminous or anthracitic coals should prove very efficient as household fuels.[22]

In the bituminous class the Dominion Government

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21 British Thermal Unit. The amount of heat required to raise the temperature of one pound of water at its maximum density, 1 degree F.

22 Vide The Coals of Canada. An Economic Investigation. Vol. 11. p. 45 et seq. for complete statistical information.

officials made seven tests on coals from the Frank-Blairmore fields. A summary of the results obtained (see table given below) showed calorific values ranging from 11,630 to 12,900 B.T.U.'s per pound. The average of the seven was 12,357 B.T.U.'s. The average of the efficiencies shown in the index number column equals 86. In general the report found them to be good steam coals, comparatively low in volatile matter. They contained a relatively high percentage of ash. All had good boiler efficiencies. Of the seven coals tested four were burned with forced draft and the volume of smoke in each case was described as "dense." Of the three burned with natural draft the description of the smoke volumes was "not much," "moderate," and "rather heavy." The flame in all cases was "moderate," while trouble caused by clinker was almost negligible.[23]

Table to show evaporation with Alberta bituminous coals

Description	Calorific value per pound as fired	Moisture in coal as fired	Ash and clinker in dry coal %	Index No.	Equiv. Evap. per lb as fired
Leitch Colliery—Passburg	12130	0.9	17.	76.4	6.61
Hillcrest Colliery—Hillcrest	12360	0.8	15.5	89.3	7.63
" " " (Washed)	12900	3.8	9.5	91.3	7.77
Bellevue Colliery—Bellevue	12280	0.8	14.1	85.8	7.41
" " " (Washed)	12510	3.6	10.5	86.4	7.40
No. 2 seam Denison Colliery—Coleman	11630	0.8	18.8	83.3	7.17
No. 2 seam Denison Colliery—Coleman (Washed)	12690	3.7	10.6	89.8	7.60

In the tests made on the lignites taken from three different fields, the tabular results of which are summarized below, the moisture and ash contents were reported as very high. On the whole the calorific value was correspondingly low, averaging only 9,763 B.T.U.'s per pound. The index number averaged only 62.8 indicating that the steam producing efficiency was quite low as compared with the other classes of fuel. The one feature that would make them attractive as household fuel was the fact that there was almost no smoke. That advantage was offset to a certain extent by their bad clinkering qualities[24]—a feature which may have been caused by the type of grate used in the tests. That would seem to be the only logical explanation of the contradictory evidence, on that point, given before the Select Committee in 1923. One

23 Ibid.
24 Ibid.

witness testified that the Domestic Coal, in which the lignites are included, is unusually free of dirt, slate, stone, etc., and that the ash content does not run above 7 per cent.[25]

Table to show evaporation with Alberta lignite coals

Description	Calorific value per pound as fired	Moisture in coal as fired	Ash and clinker in dry coal %	Index No.	Equiv. Evap. per lb as fired
Parkdale Coal Co. Edmonton	8760	19.7	11.4	62.7	4.98
Canada West Coal Co. Taber	9790	11.3	17.3	57.2	4.91
Galt Colliery, Lethbridge	10740	8.3	10.4	68.7	5.92

In a series of special tests made by the Department of Mines in 1925, at the Ottawa Fuel Testing Station in an endeavour to determine definitely the value of Alberta coals as household fuels some interesting figures were obtained. The tests were all conducted in a hot-water heater of a size generally recommended for a house of eight or nine rooms[26]. The conclusions arrived at as a result of those tests were that of the Alberta Domestic Coals from 12.96 to 16.73 tons are required to equal in heating efficiency 10 tons of American anthracite[27]. An average of the eight tests made on coals of these two classes shows 14.75 tons are needed to produce as much heat as 10 tons of the imported household fuel. The official wording of another report states: "The 'Domestic Coals' have one disadvantage in that they are of a distinctly lower heating value than anthracite or coke."[28]

To sum up, then, it may be said that the bituminous coal of Alberta compares very favourably with steam and coking coals from other sources. The semi-bituminous and anthracitic coals of the Canmore fields are best suited for steam purposes because, although they are practically smokeless, their friable nature renders them in the raw state at least, unsuitable for household use. The lignites and the sub-bituminous coal, besides being smokeless, have the advantage when freshly mined, of being comparatively good handling coals. Unfortunately, they lose that property soon after exposure to air.

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25 Appendix No. 6 Journals of the House of Commons 1923, p. 97, 98.

26 Canada Department of Mines. Investigation of Fuels and Fuel Testing 1925. No. 671-2. p. 3.

27 Ibid. p. 32.

28 Dominion Fuel Board, Second Progress Report 1923-1928 p. 25.

CHAPTER III.

DEVELOPMENT OF THE "DOMESTIC COAL" INDUSTRY IN ALBERTA

Previous to 1918 the importations of coal from the United States to Manitoba and the North-West were approximately two and a half million tons of which nearly half a million was anthracite[1]. Early in that year, at Conventions held to discuss the fuel needs of Western Canada, the Alberta operators decided that they could supply the entire demand of that area[2]. Complaints arose from the representatives of the domestic consumers of anthracite, alleging, firstly, that Winnipeg in particular had no means of storing coal, having depended in the past on the storage facilities available at the head of the Lakes, and secondly, that householders had not the necessary equipment for burning lignitic coals, and that as a consequence, any diminution of the regular supplies of anthracite coal for that market would inflict serious hardships upon the consumers[3]. The announcement of a representative of the United States Fuel Administration to the effect that "the policy of his administration would be to meet fully the anthracite needs of the territory east of Buffalo while the territory west thereof would have to look to some considerable extent to local fuels, and that the same policy would apply to Canada,"[4] forced the householders of Manitoba to a realization of the gravity of the situation. The seriousness of the existing circumstances was revealed even more forcibly to them when at a public meeting held at Winnipeg on May 14, 1918, the Fuel Controller announced that "householders would be obliged to stock up with lignites to the extent of 50 per cent. of their normal requirement before they would be allowed to purchase any anthracite."[5] The final assignment of anthracite supplies for the following winter was later fixed at 65 per cent. of the normal require-

1 Final report of the Fuel Controller 1919. p. 26.
2 Ibid. p. 26.
3 Ibid.
4 Ibid.
5 Ibid.

ments for the city of Winnipeg and 50 per cent. for the rest of Manitoba and eastern Saskatchewan[6].

That enforced curtailment of the normal anthracite supplies of the western market as a war-time measure gave the producers of Alberta's sub-bituminous and lignitic coals (now advertised as Domestic Coal) the opportunity for which they had long been struggling. They took advantage of the opportunity with the result that the same season saw the beginning of an organized movement to capture in its entirety the market for household fuel in the province of Manitoba.

In the winter of 1919-20 the Alberta Government, in an attempt to aid the producers in their worthy attempt to capture the prairie market, stationed in Winnipeg a Trade Commissioner, and a combustion engineer[7] whose duties were to advertise and demonstrate to the consumers of coal the advantages to be obtained by the use of the western product. As Manitoba was the only section where any vigorous competition with American coal was met, Winnipeg was the only place where representatives of the Alberta Government were situated. The result of the first season's activity was the introduction into that market of about 250,000 tons of coal in excess of what would otherwise have been sold there[8].

The advertising itself took several forms, but was all directed toward one goal and had for its purpose the elimination of the prejudice which existed in the Manitoba market in favour of Pennsylvania coal. Circulars, show-cards, and newspaper advertising were used extensively but what was probably as effective as anything was the attempt at education by actual demonstration. Users of steam coal were canvassed with the purpose of securing the privilege of a demonstration in their own plants[9]. Consumers of household fuel were invited to attend demonstrations on the most economical and convenient ways of burning the western fuel in the various types of heating equipment which had been set up in the offices of the representatives from Alberta[10]. Visitors were, on the whole, friendly disposed; absentees were solicited a second or third time. The whole problem, involv-

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6 Ibid.
7 Evidence of J. L. Cote before the Special Committee on The Future Fuel Supply of Canada, 1921.
8 Ibid.
9 Coal Age Magazine. 28: 700-01.
10 Ibid.
11 Ibid.

ing as it did the education of the people in a great geographical division to the proper use of the various grades of coal as well as the dissolution of the long standing prejudice in favour of the imported product, was recognised as one of gigantic proportions and one fraught with many difficulties[11]. In spite of the obvious uphill nature of the task, the result for the first year's activity was quite satisfactory[12].

So quickly did the Albertan coal operators become imbued with the idea of capturing the Manitoba market in its entirety that they began to dump all kinds of coal there with the result that much of the effective work done by the officials of the Alberta Government was rendered useless. The competition of the operators gave plenty of opportunity for new coal agencies in Manitoba to begin business. In Winnipeg alone, in 1923, there were more than two hundred registered coal dealers[13], all advertising for sale, regardless of quality, "Alberta Coal." In view of the fact that the general terminology "Alberta Coal" included every kind and grade from the poorest and least efficient lignites to the best semi-bituminous, many people, whose knowledge of the various western coals was then limited to what had been learned from the newspaper advertising, bought a ton or two as a trial sample, and all too often their ultimate opinion of it was adverse, because they had been given one of the poorest grades by some unscrupulous dealer.

In an attempt to stop such malpractices, which were serving only to defeat the work of its representatives in the new market, the Alberta Legislature passed an Act on April 21, 1923, requiring the registration of every mine operating in Alberta together with a trade name for the coal which it produced[14]. It was hoped that this Act would help reputable dealers, who desired to sell only the better grades, to develop a trade by advertising the registered trade names. It proved only partially successful during the first year or two after its adoption owing to the ignorance of the coal consuming public regarding the relative merits of the various grades of coal. The better grades and their respective trade names were soon learned, however, and in recent years the trade names came to be looked upon as the guarantees of certain grades of coal which are now well and favourably known in the rural Manitoba and Winnipeg markets.

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12 Supra p. 24.
13 Coal Age Magazine. 28: 700-01.
14 Statutes of Alberta 1923. Chapter 31.

So successful has the endeavour proved to be that, whereas in the last years of the past decade the importations of American anthracite into the territory west of Lake Superior amounted to between 400,000 and 500,000 tons annually[15], the aggregate importations to the same territory in 1927 were only 95,652 tons[16].

At the present time (winter of 1928-29) the western coal sells at Winnipeg for from $10.50 to $14.50 a ton[17]. The price of anthracite is $20.00[18]. On the supposition that the average price of the Alberta coal is $13.00 a ton and that there are required 14.75 tons[19] to equal in heating value ten tons of anthracite, then the people of Winnipeg are paying $19.18 for an equal amount of heat as would be obtained from anthracite valued at $20.00. Thus it would seem that, despite the adverse official reports as to the quality, cleanliness of handling, etc., of the coal from Alberta, and given the coal at a price which does not increase the cost of an equal quantity of heat, the consumers in the Manitoba market prefer to have the comparative certainty of supply from the western producers than the uncertainty which is ever associated with any commodity, the source of which is entirely beyond the control of the people of this country. To-day, the people, whose representatives ten years ago declared that suffering and hardship would result from any curtailment of anthracite supplies[20], are using approximately one fifth of the amount of anthracite they then used. The difference is accounted for by the greatly extended use of the coal from Alberta. Without doubt the campaign of the Alberta producers and the efforts of the provincial government had the desired effect of putting to route the ancient prejudices in favour of anthracite in that market. Can the same thing be also accomplished in the market of Central Ontario ? Is it desirable that it should?

From Alberta's standpoint it is highly desirable. In 1927 the average number of wage-earners employed in the sub-bituminous mines both above and below the surface was 635[21]. In the lignite producing districts the average was 4620[22].

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15 Final Report of the Fuel Controller, 1919. p. 26.
16 Coal Statistics for Canada 1927, p. 26 (Manitoba and Head of the Lakes plus Saskatchewan).
17 Current Advertising in the Manitoba Free Press.
18 Ibid.
19 Supra p. 22.
20 Supra p. 23.
21 Coal Statistics of Canada, 1927. p. 79.
22 Ibid.

The number of man-days work done in those mines in the same year was 156,833 and 1,083,522 respectively[23]. Hence in the sub-bituminous areas the average number of days worked by each man was 247. Similarly, the average per man in the lignite mines was 235 days. Thus out of a possible 300 working days a year all of the miners in those fields must have been idle from two to two and a half months. But a mine cannot be shut down completely for a short period of time. Some men must be employed to keep the workings in order, so that to the extent that some of the men would be employed the year round, others must have been unemployed for longer periods than those indicated.

That conclusion is justified by the statistics which show the average number of wage-earners by months. For all mines in Alberta the average number of men employed during the months of peak production, i.e., November, December, January and February was 10,835[24]. For the last month of winter, and for the early autumn, i.e., March, August, September and October, the average was 8,877. During the summer months, i.e., April, May, June and July, the average number of men employed was 7,066. In all cases the averages are surprisingly close to the actual figures for any one of the four months within the particular group[25]. When it is remembered that the bituminous or steam coal mines, relatively to the mines producing household fuel, have a comparatively steady demand, and therefore offer more nearly continuous employment, and that in those mines the annual average number of employees is about 3,600 men[26], it follows that in the other districts from 2,000 to 4,000 or more men are unemployed for periods ranging from three to six months or longer.

It was asserted in 1923 by a Trade Commissioner of Alberta that the mines of that province had an annual plant capacity of 14,000,000 tons[27]. A market then, as now, existed for less than one-half of that amount. It was that condition of affairs that led the same witness to make the following statement :[28]

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23 Ibid p. 80.
24 Ibid.
25 Ibid.
26 Ibid. p. 79.
27 Appendix No. 6 Journals of the House of Commons 1923. p. 80. Evidence, H. Stutchbury.
28 Ibid.

"In the domestic field, I think my friends from Drumheller will bear me out, the production period is under six months. Now mine idleness is a very, very serious expense. There is first the loss of efficiency on the part of labour . . . . Then there are the other fixed charges, taxes, rentals, the maintenance of pumping and other plants, timbering and all those things which go to make up overhead charges, whether the mine is operating or not. Now that has led to an excessively high cost of production, the only solution of which is an extended market."

Thus, to alleviate the hardship and suffering among the families of the thousands of miners who are periodically unemployed; to reduce the cost of fuel to the consumers in the western market; and to make for greater prosperity in the province of Alberta as reflected through the prosperity that would be enjoyed by the mining communities themselves, it seems imperative, as it did at the beginning of the present decade, that the sales of Alberta household coal should be extended beyond the confines of the present market in Western Canada.

CHAPTER IV.

THE ACUTE FUEL AREA

The domestic fuel problem in Central Canada began when the hardwood forests of the older sections of the province disappeared before the onslaughts of the axes and saws of the lumbermen and homesteaders. As farming communities expanded the "clearings" in the immediate vicinities of villages, towns, and cities signified the depletion and ultimately the exhaustion of the original supplies of fuel on which the urban centres depended. The disappearance of the hardwood forests from the countryside around the more densely populated centres gave rise to the fuel problem. The greater the distance became over which the firewood had to be transported, the greater became the price. Clearly it was only a question of time before the available supply of firewood would be entirely inadequate to meet the demand. With these facts before them the people began to look for a substitute fuel. This they found in the coal mines of Pennsylvania.

As early as 1868 the importations of coal into Canada amounted to 356,836 tons[1]. Of this it is safe to assume that less than one-half was domestic fuel, i.e. anthracite.[1a] Doubtless the greater proportion of this coal was imported into the provinces of Ontario and Quebec. Certain it is, that in the absence of railway transportation none of it went to the North-West, and it is altogether unlikely that any considerable amount was imported into the Maritimes where the total demand was being supplied by the coal produced from the Nova Scotia and New Brunswick mines[2].

With the exception of parts of the years 1870 and 1871 there was no import duty on any coal brought into Canada until the year 1879 when by the adoption of the National Policy the Conservative Government placed a duty of 53 cents

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1 Canada Statistical Record 1902 p. 455.

1 (a) In 1877, the first year in which the distinction was made in the import records, the proportion was four ninths anthracite and five ninths bituminous.

2 Dominion Annual Register 1880-81 p. 452.

a ton on coal of all kinds. The imposition of the duty on the household fuel did not check the demand, however, which continued to increase steadily but none the less surely. In 1878 the total importation of anthracite was 406,971 tons; in 1879 it increased to 416,423 tons and in 1880 there was a further increase of over 100,000 tons[3].

The effect of the tariff on bituminous coal, used chiefly in the factories, was noticeable however in two instances. Firstly, the imports which in 1878 were 456,090 tons, increased slightly in 1879, when the new tariff was in force for only the last half of the year, to 473,313 tons, and then in 1880 decreased to 457,049 tons[4], showing the steadying effect of the tariff on that commodity. Secondly, and coincident with the first, was the marked increase in the production at the Nova Scotia coal-fields. For the three years previous to 1880 the amount of coal raised from the mines of Nova Scotia had ranged between 848,395 and 882,863 tons[5]. In 1880 the increase was very marked, the total output being 1,156,635 tons[6], below which the annual production never again fell. Doubtless the Maratime coal was transported westward to the industrial centres of the lower St. Lawrence before the imposition of the tariff. That market must have been extended by the distance over which the 53 cents duty would pay the cost of transportation. It was said that " since the imposition of a duty on that article (imported bituminous coal) the manufacturers of Ontario and Quebec have used it (Nova Scotia coal) to a very considerable extent, even as far west as Cobourg and Guelph."[7]

The introduction of the National Policy was a signal for the producers of anthracite coal to put forth every effort to secure the household coal market of Canada entirely for themselves. " Development of Pennsylvania coal mines and the advertising which Pennsylvania coal barons gave to that coal at the fall fairs in Canada brought a new era.

" At those fairs anthracite coal was burned in stoves from coast to coast, as a demonstration, and finally the habit of burning anthracite coal became fixed on the people of Canada."[8]

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3 Statistical Year Book 1895, p. 419.
4 Ibid.
5 Ibid. p. 414.
6 Ibid.
7 Dominion Annual Register 1880-81, p. 452.
8 House of Commons Debates, 1923, p. 1262.

The price was evidently a developmental rate, intended to be so low as to reduce to a minimum the probability of people using bituminous coal as an alternative, a habit which, had it been allowed to develop, might have been difficult to change at a later date. Despite the duty of 53 cents a ton, coal which sold at the mines for between $3.00 and $4.00 a ton[9] during the early eighties was delivered in Central On tario cities for $5.50.[10] There was, however, much truth in the opinions expressed by the members of the opposition in the House of Commons concerning the uselessness of the duty on the anthracite coal. On March 30, 1882, Mr. Laurier (later Sir Wilfrid) moved a resolution "that in the opinion of this house the public interest would be promoted by the repeal of the duties imposed on coal, coke, and breadstuffs, free under the former tariffs . . ." In support of the resolution the argument was used that the duty on bread and flour had not contributed one cent to the profits of the farmers of Ontario though it had acted as a great injury to both Lower Canada and the Maratime provinces, and that the same thing was true to an even greater extent with regard to coal. The people of Ontario paid the duty and the miners of Nova Scotia derived no benefit from it. "In short," it was said, "the duties on wheat flour, meal, and coal injured the consumer without benefiting the producer."[11] As there were no anthracite coal mines in Canada the logic of the argument respecting that product, at least, was obvious. It was not until 1887, however, that the duty on hard coal was removed. Since that year anthracite has entered Canada duty free.

At the turn of the century the importations of anthracite averaged nearly one and three-quarter million tons—of which the great bulk went into Ontario and Quebec. Only a few thousand tons were shipped to Manitoba and the North-West[12] and it can be assumed that very little found its way to the Maritimes, where at the present time the total importations of American hard coal averages less than 100,000 tons annually.[13]

With the steady growth of population in the central

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9 Values of imported product as per Statistical Year Book of Canada 1902, p. 455.
10 Appendix 6, Journals of the House of Commons 1923. Evidence of W. L. Wanklyn.
11 House of Commons Debates 1882, p. 637 et seq.
12 Appendix F.F.
13 Coal Statistics for Canada 1927, p. 26 et seq.

provinces the dependence on anthracite as a household fuel increased proportionately. At the end of the Great War Canada was importing approximately 5,000,000 tons annually[14]. Of this less than 500,000 tons went to the western provinces[15] and as pointed out above not more than 100,000 to the eastern seaboard. Thus Ontario and Quebec at the beginning of the present decade were dependent upon the United States for their winter's warmth to the extent of about four and a quarter million tons of anthracite coal for which the consumers were paying prices ranging from $16.00 to $20.00 a ton[16] and in times of scarcity the price was sometimes more than that. Furthermore, the quality was deteriorating[17].

The reason for that inferiority was not far to seek. The better seams of coal were being gradually "worked out." Operations were being forced into the thinner and more inaccessible seams. As a result of this it was not to be expected that either the price would fall or that the quality would become better. On the other hand, it was quite within the bounds of possibility that, in the future, these unfavourable conditions would be aggravated.

The feeling of insecurity regarding the reliability of a constant supply of anthracite occasioned by the shortages during the Great War[18] was accentuated by the industrial unrest and labour troubles of the United States coal-fields early in the present decade. In 1922-23 when the miners in the Pennsylvania anthracite fields were on strike and when the operators were shipping coal from their stacks into Canada in fulfilment of contracts previously entered into, the people of the northern United States, who were also suffering from lack of coal, endeavoured to restrict the export of their fuel. So persistent did that demand become that the leading newspapers took up the cry. A prominent New York editor wrote as follows: "It is reasonable to ask Canadians why they do not use their own coal, of which they have in Cape Breton as much as they choose to dig . . . . . That they like hard coal better is no reason for pretending that they will freeze if they do not share our inadequate supply."[19]

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14 Canada Year Book 1927-28, p. 383.
15 Supra p. 26.
16 Appendix 6, Journals of the House of Commons, 1923, Evidence W. L. Wanklyn.
17 Ibid.
18 Supra p. 24.
19 Editorial New York Times quoted. House of Commons Debates 1923. p. 1267.

The attitude of the public in the United States was, no doubt, superficial, occasioned largely by the shortage of coal at the moment. There was, nevertheless, an official attitude which gave the Canadian people just cause for apprehension. The geologists, and the Conservation Committee of the United States were, and had been for five or six years, advocating an embargo on coal to Canada[20]. That this attitude was not latent was exemplified on two occasions. Early in February the Administrator of the State of New York and Governor A. Smith telegraphed President Harding asking that the exports be cut off[21]. Following that came the introduction of a Bill in Congress on February 17, 1923, "Authorizing the President to declare an embargo on coal.

"Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled. That whenever the President shall find that the public interest so requires he is hereby authorized to declare an embargo on the exportation of coal to foreign countries; such embargo may include either anthracite or bituminous coal or both and may be complete or partial: Provided, however, that without further authority of the Congress no such embargo shall continue in operation for a period of more than six months at any one time."[22]

Needless to say, the Bill did not become law but the fact that there was sufficient consideration of the question in official circles to permit of its being put before the House of Representatives, was a warning to the people of Ontario and Quebec that they should seriously consider ways and means of making themselves independent of the United States in the matter of the supply of their household fuel.

The beginning of the movement for a National Fuel Policy thus arose out of the threat of insufficient supply from the foreign sources. It found official expression for the first time on April 1, 1921, when a motion was passed in the House of Commons, to the effect "that a Special Committee . . . . be appointed to enquire into all matters pertaining to the future fuel supply of Canada, ..."[23]

The committee appointed examined 37 witnesses during

20 House of Commons Debates 1923, p. 1265.
21 Coal Age Magazine, Vol. 23, No. 7, p. 311.
22 Quoted. House of Commons Debates, 1923, p. 1279.
23 House of Commons Debates, 1921, p. 1439.

the course of 26 sessions and presented its final report and recommendations in June. During the course of the investigation evidence was obtained on such subjects as the fuel resources of Canada according to provinces; the production of coal in Canada and the distribution thereof; the importation and distribution of United States coal; transportation by rail and by water throughout Canada; industrial and household fuel; and possible substitutes for coal[24]. Among the recommendations handed down by the committee were the following:[25]

1. There should be an officer of the government appointed for the purpose of keeping in close touch with the fuel situation of Canada, and that he should be given sufficient powers to enable him to cope with any emergency that might arise with regard to an insufficient supply of fuel for either domestic or industrial purposes.

2. That waterpowers should be developed to the greatest extent possible in order to supply energy to industrial plants.

3. That the question of electrification of railways in districts where the use of Canadian coal is not economically justified should be given serious consideration.

4. That everything possible should be done to reduce the cost of transporting coal by water.

5. That people should be encouraged to use domestic coal, coke, peat and briquettes, when obtainable, instead of the imported anthracite.

6. That all consumers and particularly domestic consumers should be urged to purchase their coal in the early summer when transportation facilities are at their best for the distribution of coal and that the transportation companies be asked to assist in accomplishing this end by granting a substantial reduction in freight rates at such seasons.

7. That Canadian coal operators be encouraged to produce and store large quantities of coal at various suitable points in the acute fuel area.

8. That a publicity campaign be maintained for the purpose of educating the people of Canada to the need of using Canadian coal wherever possible, and to inform them of the

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[24] Special Committee of the House of Commons 1921. Future Fuel Supply of Canada. p. V.
[25] Ibid. p. IX.

best methods of using the various fuels, for both household and industrial purposes.

The outcome of these recommendations, together with the immediate necessity for such an organization owing to the acute fuel situation which arose in the autumn of 1922, was the appointment of the Dominion Fuel Board by an Order in Council approved on the 25th November 1922[26]. Its aim was " to make a thorough study of Canada's fuel problems . . . with a view to arriving at such solutions as may be in the public interest."[27]

The Board early recognized that the most important problem confronting it was that concerning the supply of an acceptable household fuel and to the solution of this problem its members turned their energies. At least that was a start in the development of a national fuel policy.

The same winter (1922-23) witnessed the greatest suffering and hardship owing to lack of fuel that the people of Central Canada had endured in many years. The strike of the anthracite miners in Pennsylvania coal-fields lasted for 5 months in 1922 during which time not a ton of coal was extracted[28]. The coal operators and railway men were, unlike the consumers of the United States, sympathetic with Canadian needs and did their utmost to fill orders that had been placed before the strike began[29]. But the Canadian people needed coal, not sympathy, and when the price of anthracite increased to more than $20.00 a ton, and at times during that winter was unobtainable at any price[30], further official action was taken.

On March 19th an amended resolution was passed " That in the opinion of this House the time has arrived in Canada to have a national policy in relation to its coal supply and that no part of Canada should be left dependent on a United States coal supply, and that the whole question of a fuel supply for Canada together with the question of costs, transportation, desirable inter-provincial action and other means whereby Canada may be self-sustaining and self-supporting as regards fuel, and to inquire into the necessity and possibil-

26 Interim Report of the Dominion Fuel Board 1923.
27 Ibid.
28 House of Commons Debates 1923, p. 1262.
29 House of Commons Debates 1923, p. 1279.
30 Ibid. p. 1272.

ity of supplying substitutes for coal be referred to the standing committee on Mines and Minerals and that the said committee report to the House."[31]

Thus was official sanction given to a National Fuel Policy—a policy born of the exigencies of war and developed by the hardships suffered during a period of industrial strife in a foreign country. It was primarily a policy evoked because of the needs of Canadian consumers. It developed into a policy which sought the solution of the problem not only from the point of view of the Canadian consumer, but also that of the Canadian producer[32].

The first and most urgent problem to be solved by the committee was to find the best method of supplying the mass of the people with a suitable, acceptable, household fuel. "Cheaper fuel for the masses. Let the millionaire buy what he likes," was one expression of the situation. But cheapness was not the only consideration. Dependability of supply was even more important, and toward that objective was given the attention of the investigators.

That there was in Canada an ample supply of coal was early established. Evidence was submitted attempting to prove the suitability of certain grades of western coal for household purposes, and to disillusion those who believed that all western coals, being high in volatile content, were necessarily smoky and dirty[33]. The example of the recent change from the use of anthracite to the Alberta Domestic Coals in the Manitoba market was cited. Surely there was conclusive proof that, given an equal amount of heat for the same or less money, the people, once they became accustomed to using it, found the Alberta Domestic Coal quite satisfactory. The major problem then seemed to resolve itself into one of placing on the Central Canadian market the coal of Western Canada at such a price that it would cost no more per heat unit than the imported commodity. "The more I have studied this question," testified one witness, "the more I am convinced that there is not a fuel problem in Canada. The problem is one of transportation and distribution of the immense fuel resources of Canada from their point of origin to their place of consumption."[34]

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31 Ibid. p. 1284.
32 Supra p. 28.
33 Appendix 6. Journals of the House of Commons 1923, p. 162. et seq.
34 Appendix 6. Journals of the House of Commons 1923, p. 79. Evidence: H. Stutchbury.

Much of the evidence taken by the Committee was concerned with the possibilities of transporting western Domestic Coal, the prevailing freight rate on which was previously $12.70 a ton, from producing points in Alberta to Toronto. The official report states: "The railway companies were asked for a rate from Alberta to Ontario . . . . The Canadian National quoted a rate of $9.00 per ton in trains of fifty car loads, for the months of May, June and July, with a similar decrease in rates from Maritime points. The C.P.R. state that the actual cost of carrying coal from Lethbridge to Ontario points in 46-ton car loads is $9.90 per ton."[35]

Among the recommendations, some of which were not dissimilar to those of the Special Committee of 1921[36], was one to the effect that "the Government undertake an independent investigation immediately, through whatever channels it seems best, to ascertain the actual cost of carrying coal from eastern and western points to Central Canada. We believe that our National Railway should carry fuel at cost in this crisis, and your committee suggests that the rates quoted are not cost rates but much higher."[37]

The first shipments of coal of any importance were made from the western mines into Central Ontario during the following summer (1923). Subject to the $9.00 rate quoted by the Canadian National Railways, 3,064 tons were moved[38]. Negotiations were continuing at the same time between the Alberta Government and the C.N.R., the result of which was the granting by the railway early in the summer of a $7.00 rate. Under that rate 14,356 tons were brought east before the grain season began[39]. The Dominion Government meanwhile was making absolutely no attempt to give effect to any of the recommendations handed down during the previous session by the Standing Committee on Mines and Minerals[40]. The whole of the 1923 movement was sponsored by the government of the western province.

The $7.00 rate was not renewed in 1924 and as there was no doubt that the $9.00 rate was too high to warrant any movement of western coal to Central Canada, there was practically none shipped in that year.

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35 Ibid. p. 8.
36 Supra p. 33.
37 Appendix 6. Journals of the House of Commons 1923, p. 9.
38 Canadian National Railway Files.
39 Ibid.
40 House of Commons Debates 1924, p. 868.

In the spring of 1925 negotiations between the governments of Alberta and Ontario were begun with a view to securing a further movement at the $7.00 rate. Those governments in turn looked to the Dominion government for aid. In June it was announced that the Federal authorities were prepared to pay a maximum of $1.00 per ton to the railways if the Alberta government or the two provincial governments interested would agree to pay an amount of not more than $1.00 per ton so as to guarantee to the National Railways the $9.00 rate in the event of the cost amounting to that rate. The cost was to be determined by a definite system of checking to be performed by competent checkers. Thus in case the cost, which was to be determined by close observation of the movement for that season, was above $7.00 per ton the National Railways were guaranteed the additional cost up to the amount for which they had agreed to transport the coal in 1923; viz., $9.00[41].

Difficulties regarding the basis of adjustment of costs as between the Ontario and Alberta governments arose. No final agreement was reached. On June 25th, Sir Henry Thornton authorized the shipment of coal to the extent of 25,000 tons to take place until August 15th. The rate that was to be in effect was $7.00[42]. Of that amount only 17,500 tons were actually transported prior to the date specified, but the remainder was brought east in the month of January 1926[43]. Owing to further labour disputes in the coal fields and on the railways of the United States there developed a serious coal shortage during the winter. The Canadian National officials, under pressure exerted by the Ontario Government and the Dominion Fuel Board, authorized further movements of 25,000 tons each on January 25 and February 6. Both movements were completed before April 17, 1926[44].

Thus in a period of nine months, during which the grain season intervened, there were 75,000 tons of Alberta domestic coal distributed widely in Ontario. Not only did the larger centres like Toronto and Ottawa receive shipments, but many smaller places scattered from the Ottawa River on the east to Goderich, Chatham, Paris and Brantford on the west and from towns and cities on the shores of Lake Ontario to Owen Sound, Huntsville, North Bay and Capreol in the north re-

41 Supra p. 37.
42 Canadian National Railway files.
43 Ibid.
44 Ibid..

ceived shipments of various sizes[45]. Such a wide distribution was ample to give people throughout Ontario an opportunity to express their opinions as to its merits. It was officially stated that " in nearly all cases consumers returned favourable reports as to the qualities as shown in practical burning tests."[46]

That was a movement of coal from the west which took place partly in the summer, when it could be transported most cheaply; partly in the winter when cost of operation on the railways is high and equipment least efficient; and partly in the early spring when a happy medium of costs should under ordinary circumstances exist. In that movement coal had been transported from such representative producing points in Alberta as Wabamun, Drumheller, Edmonton, and Evansburg to representative consuming points throughout the length and breadth of the acute fuel area with the exception of the Montreal district. But to what purpose ? Nothing regarding the actual cost of moving the coal was determined, because the governments interested did not create any system for checking it[47]. Hence an excellent opportunity to determine the cost of actually transporting the coal, in as far as such cost can be determined by any superficial system of checking, was allowed to pass.

While the idea that a system of checking would determine accurately out-of-pocket expenses was still prevalent, the Federal authorities determined that some definite information should be obtained by what seems to be the only logical method. Accordingly in February 1926 an Order in Council[48] was approved which referred the whole matter to the Board of Railway Commissioners for Canada. The order requested that body " to immediately inquire and report to the Government upon the question of the cost of transportation of coal per ton in full capacity train-load quantities" during the summer season. It was required that the report should "show as nearly as practicable the particular cost of such movement, both exclusive and inclusive of costs that would have to be incurred by the railways in any event . . . . and both exclusive and inclusive of the element of profit to the transportation companies."[49] Thus it was proposed that the

45 Ibid.
46 Dominion Fuel Board. Second Progress Report, p. 26.
47 House of Commons Debates 1926 p. 335.
48 Order in Council P.C. 225 dated February 13, 1926.
49 Ibid.

Board should determine as nearly as possible three different rates. The first was to show the actual out-of-pocket expenses, the second was to include the expense as determined in the first and the proper proportion of overhead, fixed charges, etc., and the third was to be based on that determined in the second instance plus the element of profit.

Owing to the length of time required by the railway, and provincial government experts to gather the statistical information necessary for such an enquiry; and owing to the fact that much time was devoted during 1926 to the hearings in the General Freight Rates Investigation, the coal enquiry was postponed from time to time until May 26, 1927. The findings of the Board, which will be considered later were published September 22, 1927.

During the late summer of 1926 when the hearing was being periodically postponed, it was proposed to ship 6,000 tons of coal in three, full, 2,000-ton train-loads. The shipments which were to be from Lethbridge, Drumheller and Edmonton to Toronto were each to be checked as to cost. Said the promoter of the scheme, "I propose by so doing to take an accurate log of the operating charges to definitely prove the out-of-pocket cost."[50] The final arrangement, after much negotiation as to what body should be responsible for the freight charges, was that the railways should look to the Department of Railways at Ottawa for the whole sum, the Dominion Government assuming the responsibility of making satisfactory adjustments with the provinces concerned[51].

Of the proposed shipments only the one from Drumheller actually occurred[52]. On account of it the Dominion Government's share of the freight charges amounted to $4,296.08.[53] No cost data concerning the special movement were submitted to the Board of Ry. Commissioners in the course of the inquiry of 1926-27. If any cost data were obtained it has never been made public and is not now (1929) available[54].

Still undecided in March 1928, despite the report issued in the previous year by the Board of Railway Commission-

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50 Telegram: R. B. Bennett of Calgary to Premier Ferguson at Toronto. Canadian National Railway files.
51 Order in Council P.C. 1446. Sept. 24, 1926.
52 House of Commons Debates 1927, p. 2322.
53 Ibid.
54 Information received from the Dominion Fuel Board.

ers, as to what might be considered an equitable freight rate on such a movement as that under consideration, the Government issued an Order in Council which was approved on the 16th of that month. By it a temporary rate of $6.75 a ton was established, to be effective for not less than three months annually during the period of the test movement which was to be of three years duration. It provided that the cost of the movement be supervised by the Board of Railway Commissioners. It further provided that the cost be carefully checked by representatives selected by both the coal interests and the railways; and that from the evidence submitted to them by those representatives the Board should determine what it considered to be a reasonable rate per ton. Pending a final decision the Board was to determine what amount, if any, over and above the rate of $6.75 per ton should be paid to the railways at the end of each seasonal movement[55]. To secure the railways against loss during the period of the test an item for $15,000 in the estimates of the Department of Mines, out of which payments should be made, was agreed to on March 19.[56]

Shipment began on April 15 and continued until July 15, during which period the Canadian National Railways transported 26,719 tons and the Canadian Pacific 5,345 tons[57]—a meagre amount on which to attempt to arrive at any definite conclusions as to the cost of hauling.

In December 1928, on application of the Provinces of Alberta and Ontario, the Board of Railway Commissioners issued an order which provided that the 1929 movement should be for the period from January 15 to July 15 instead of for three months only, as it was in 1928[58].

At the time of writing (March 1929) no decision has been made by the Board as to the amount that will have to be paid to the railways in respect of the 1928 movement to recompense them for the difference, if any, between the $6.75 rate and the actual cost. Any amount to be decided upon will, of necessity, be of discretionary nature and will not, presumably, be significant of what may be the final decision of the Board after the three year period will have elapsed in 1930.

The future holds that decision.

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55 Order in Council P.C. 439, March 16, 1928.
56 House of Commons Debates 1928, p. 1519.
57 Canadian National Railway files.
58 Board of Ry. Commissioners for Canada. Order number 41897.

CHAPTER V.

THE TRANSPORTATION PROBLEM

"Charging what the traffic will bear" is the recognized theoretical principle by which to determine freight rates. This general theorem is subject always to the qualification, as pointed out by an eminent authority on railway freight rates, that no rate should be so low as not to cover the additional cost incurred by the railway in dealing with the traffic to which the rate applies[1]. Strictly speaking, cost of services, as shown by another authority "includes all the expense chargeable against the service—interest on capital employed, deterioration of plant, insurance, wages, outlay for operating expenses, ordinary business profits, etc."[2] In practice, however, cost of service is often taken to mean merely the extra, or out-of-pocket expense incurred in performing the service; that is, the expense that would not have been incurred had the freight not been carried.

On a railway, therefore, the rates on which, by virtue of the established traffic, already pays the cost of service, as defined in practice, plus all fixed charges and a profit on the capital invested, any additional traffic will be advantageous to the railway if such traffic pays anything above the out-of-pocket costs, i.e., the operating expenses applicable to that traffic. Any revenue over and above the out-of-pocket expense will merely go to swell the profits. Similarly on any railway on which the existing freight rates more than pay operating expenses, any additional traffic that pays more than the out-of-pocket costs of handling it will be advantageous, because anything over and above those costs for the additional traffic will go toward the defrayment of fixed charges.

Applying this theory to the movement under consideration, the Canadian Pacific Railway should find the additional traffic advantageous because anything over the actual cost would go to swell the profits of that company. The Canadian National Railway should find it advantageous in as much that anything above the actual cost would contribute to the payment of any fixed charges not already met by existing revenue. The problem then resolves itself into determining what rate

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1 Elements of Railway Economics, p. 78.—W. M. Acworth.
2 Principles of Railway Transportation, Ch. XXI.—Johnson & Van Metre.

will pay the variable expenses applicable to this particular traffic.

What is a fair freight rate for the coal ? What enters into the cost of transportation ? Many theories, each supported by an enormous amount of statistical data, have been offered. Private engineers, the railways, and the governments of the two provinces particularly interested have all disagreed as to what might be considered an equitable rate. The estimates range from $5.75 a ton as a rate profitable to the railways to $9.95 a ton as representing only the additional cost of carrying the coal. They have been constructed on every conceivable basis for making railway rates.

At one extreme is a rate calculated on an almost ideal situation—the use of the largest type of open-top coal cars now constructed, hauled by the largest and most powerful types of freight locomotives in use anywhere in the world, over a roadbed presumably capable of carrying such weight, in through, train-load lots from Alberta to Ontario. At the other extreme is the attempt to calculate the cost of moving a ton of coal—it might as well be a ton of any other commodity—from Alberta to Ontario by using the average per ton-mile rate as computed for the total tonnage of all commodities hauled over all sections of Canada's vast railway systems in some presumably average year. Is there a via media between these two extremes ? Is it possible that there is a rate which will fall between the lowest, as calculated by the most ardent advocates of a policy that would ensure the use of Western Canadian coal in Central Canada, and the highest estimates of those who oppose such a policy ?

A consideration of the factors governing the actual transportation of the coal shows, unfortunately, that facilities which are instrumental in providing the lowest possible rates are not suitable in this particular instance. In certain sections of the United States where hauling coal (e.g. the Virginian Railway) is a highly specialized business, open-top cars, full trains of which are pulled by the largest type of freight engines in existence, are used[3]. Were it admitted that the railways of Canada would be justified in making huge capital expenditures for equipment of this type, to say nothing of the expenditure that would have to be made on line structures, round-houses and terminal facilities in order to accom-

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3 The mallet type engine, of 147,200 pounds traction effort handles, regularly, gross trains of 8,000 to 9,000 tons. The cars used are 100-ton, flat bottom Gondolas, 50 to a train, i.e., 5,000 net tons of coal per train. A record was made on May 5, 1921, when a train of 10,000 net tons (16,000 gross) was handled.

modate the heavier and enlarged equipment, there still remains the fact that the western household fuel has not the physical properties to withstand this method of transportation. "It would not be possible to ship many of our coals which are quite suitable for this market to Ontario in open cars; we could not use the big American gondolas," declared an Alberta witness upon one occasion[4]. In other words it is necessary to use covered cars the only types of which existing at the present time being the ordinary box-car—the present equipment of all general purpose railways.

A further limiting factor in respect of the proposed movement is the effect of the western grain season. The "grain rush," as it is popularly called, begins about the last week of August, is at its height by the middle of September, and continues at peak activity until the lower lakes freeze in early December. Thereafter there is a gradual decline in the movement of grain until the elevators, and boats which tie up at the head of the lakes for the winter, are filled to capacity. By the first of January practically all grain shipment ceases. Thus from the beginning of August, when the railways start distributing the box-cars over the length and breadth of the prairies, until the end of December every available car is in use. Were the circumstances such that special cars could be set aside, earmarked as it were, for the sole purpose of transporting coal, it is still doubtful whether it could be moved during that period, owing to the congestion of traffic between Winnipeg and the Head of the Lakes.

In any event, it would be grossly unjust to expect the railways to carry the coal during that season at any rate which would be less remunerative than the rate on grain. For example, the distance from Lethbridge, a place where one of the most suitable grades of coal is mined, to Fort William is c. 1185 miles; from Fort William to Toronto, 813 miles:—a total of 1998 or in round figures 2000 miles. The statutory maximum rate on grain, the rate which now prevails, is $5.20 a ton to Fort William. On a mile for mile basis therefore the rate on coal from Lethbridge to Toronto would be:

$$\frac{1998}{1185} \times \$5.20 = \$8.77 \text{ a ton,}$$

a rate which, in the light of the experience of the last six years, would preclude any possibility of the coal being marketed in Ontario in competition with the imported commodity. Thus, for various reasons, it is evident that any movement

[4] Evidence, Trade Commissioner of Alberta. Appendix 6. Journals of the House of Commons 1923, p. 91.

of coal during the period of the "grain rush" is not to be considered.

Any movement of coal from Alberta must therefore be accomplished between January 1st and August 1st of each year. Of this period the months of May, June and July are months in which the thoughts of consumers of household coal are not concentrated on the need for artificial heat. Dealers hesitate to purchase during that season for various reasons among which are the following :

1. Lack of storage space for large quantities of coal of any kind.

2. Lack of any storage space that would adequately protect the western coal which, during the hot summer, must be kept under cover to protect it from sun and rain[5].

3. The fact that, owing to the friable nature of the coal when weathered it is found necessary to handle it, wherever possible, directly from the cars to the consumers' basements. This practice is maintained to a great extent in Winnipeg where the rail haul is less than half as far as is that to Central Ontario[6].

4. The natural aversion of dealers to investing money in a large stock of goods for which there will be absolutely no demand until nearly six months later.

The effect of these factors which militate against a great movement during the early summer months is noticeable in the figures pertaining to the shipments in 1928 under the subsidized freight rate. In April and the early part of May when there was still a small demand for fuel the quantity shipped was considerably greater per week than during the summer months.

Canadian National Shipments of Alberta Coal 1928[7]

Period	Number of Cars Shipped	Average Per Week
April 15 - 21	134	134
April 21 - May 5	145	73
May 5-12	28	28
May 12 - 19	31	31
May 19 - June 9	114	38
June 9-16	31	31
June 16-21	28	28 (5 days)
June 21 - July 15	207	51

5 Supra p. 17. Also, evidence G. R. Pratt, Fuel Engineer for the Alberta Government. Appendix 6, Journals of the House of Commons, 1923, p. 303.

6 Appendix 6, Journals of the House of Commons, 1923, p. 303.

7 Canadian National Railway Files.

The increase in the number of cars shipped during the last three weeks was evidently owing to last minute attempts on the part of the dealers to put in small stocks in preparation for the early autumn demand.

It may be said, therefore, that until the people of Central Canada are convinced that it is to their own interests to buy and have placed in their basements, during the summer months, the coal that they will need in the first half of the following winter, there is little prospect of having an extensive movement of coal from the west in May, June or July. In this connection it is interesting to note the experience of Winnipeg dealers when an attempt was made in that city to induce consumers to buy coal during the summer. A plan was agreed upon whereby, with a 50-cent a ton reduction in freight rates and identical reductions per ton by both the dealers and the operators, coal was offered to Winnipeg consumers at what would amount to more than a 10 per cent reduction on winter prices. It is significant that the consumers took practically no advantage of this substantial discount. They preferred to wait until the time when the coal was needed before making their purchase[8].

Without doubt, the major part of any movement of coal, unless human nature changes very considerably, will be confined to that season of the year between January and May, with a probable renewal of shipments during July, when dealers could put in a small supply for the early autumn demand. It might here be noted that with the movement confined chiefly to the later winter months there is a possibility that open-top cars of the gondola type might be used successfully. During that season, when the heat of the sun is not intense and when rain does not fall, the coal would not tend to disintegrate to the same extent that it would if shipped by the same means in summer.

From what has been said with reference to the purchase, shipping, and storage of coals during the summer it is not difficult to see the reasons for not making use of water shipment from Fort William or Port Arthur to the lower lake ports. Exclusive of the fact that there tends to be little coal shipped during the first part of the navigation season, there is another reason for the non-use of the lake route.

At the present time the empty shipping is toward the

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8 Economics of Transportation, p. 335—Jackman.

Head of the Lakes. Vessels bringing grain and ore to the lower lakes now grant very low rates on the American coal back to the upper lake ports. Otherwise they would return there in ballast. That is one of the chief reasons why bituminous coal from the United States is being imported into the Head of the Lakes and Manitoba market at the present time to the extent of over a million and a half tons annually[9]. Any increase of east bound shipping would merely mean increased empty tonnage westward—a factor which would make for high rates on the eastern movement of coal on the lakes. Furthermore, the only economical way of handling coal into boats is by having a tipple which can dump full car-loads at a time. That requires the use of open-top cars, which, as has been stated, are unsuitable for the western coal traffic during the summer, i.e., during the season of navigation. For these reasons it is unreasonable to assume that any extensive water borne movement of coal to the east can materialize in the near future.

Having considered at some length the major factors controlling or influencing the proposed movement it is well here to summarize them so that they may be kept clearly in mind when examining the question of a fair freight rate.

1. The coal must be shipped in covered cars, except probably, that which may be moved in the winter time.

2. The grain season precludes the possibility of shipping the winter's supply of fuel in the autumn—the logical time for shipments to begin.

3. Consumers of domestic coal refuse to buy and store a winter's supply of fuel when the thermometer registers 90 degrees F. in the shade.

4. The apathy of dealers toward the problem of providing sheltered storage space tends to prevent any extensive summer shipments.

5. The movement, to all intents and purposes, must be an all rail haul.

6. The combined effects of these factors tends to confine any major shipments to the first three and a half months of the year.

Under existing circumstances, therefore, it is unlikely

9 Coal Statistics for Canada, 1927. p. 22 et seq.

that Alberta coal will ever entirely supplant anthracite, or some form of prepared bituminous coal in the Central Canadian market. It might be fair to assume, however, that the market could be divided equally between the two opposing forces—the imported commodity being used in the first half of the winter and the Alberta product in the second half.

The average imports of anthracite from the United States into Central Ontario and the Montreal district during the three years ending 1927 were as follows[10]:

Locality	1925	1926	1927	Average
Central Ontario	2,182,717	2,444,280	2,113,072	2,246,689
Montreal (a)	700,000	1,050,000	800,000	850,000
Totals	2,882,717	3,494,280	2,913,072	3,096,689

(a) Arbitrary deductions have been made from the total figures quoted for the province of Quebec, hence these figures are only roughly approximate.

In order to supplant one-half of this amount; viz., 1,548,345 tons, 2,283,800 tons of Alberta coal would be necessary,[11] of which probably 2,000,000 tons or more would be moved during the winter and the remainder during the late summer season for the early autumn trade.

On the supposition that any coal shipments during the winter months could be made in open-top cars without causing undue disintegration of the coal owing to exposure a consideration of that method may here be made. In the first place there is little likelihood that any car would be available for loading more than three times in the one hundred day winter shipping season. The period of loading and assembling, the 2000-mile trip, the traffic delays en route, the distribution to various centres in Ontario, the period of unloading, the collecting of the empty cars and the return trip of 2000 miles make the above estimate appear very liberal.[12] On that basis, however, each 100-ton open-top dump car would, in each winter season carry 300 tons of coal; and consequently for a 2,000,000 ton movement approximately 6,700 cars would be needed. The cost of installing such equipment would be

10 Ibid. p. 24, et seq.

11 Supra p. 22. 10 tons anthracite equals 14.75 tons Alberta Domestic Coal in heating efficiency.

12 Railway officials estimate 50 days for round trip. Board of Ry. Commissioners for Canada Vol. XVII., No. 15, p. 447.

$45,000,000.[13] In addition to this there would be the cost of the special engines required to haul the heavy trains. In evidence given before the Select Standing Committee on Mines and Minerals 1923, it was stated that these mallet type engines were capable of hauling fifty 100-ton cars of coal.[14] Thus in order to handle the 2,000,000 tons of coal in the winter period the minimum number of engines required would be 134. They cost $100,000 each.[15] For the required motive power, therefore, an additional expenditure of $13,400,000 would be necessary. Thus the minimum initial capital expenditure for hauling equipment would approximately in round figures $60,000,000. Add to that the immense expenditures necessary to provide adequate terminal facilities, and to strengthen road structures in order to hold the exceptionally heavy trains, and the account would be enormous.[16]

In considering the cost of rolling stock only, the major portion of which would be idle for nearly nine months of the year, it is absurd to even contemplate the purchase of such special equipment. The depreciation, and interest charges on the capital invested, at 5 per cent. each per annum would in themselves constitute a fixed charge of nearly $3.00 a ton against the coal moved.

For all practical purposes therefore the whole scheme must be considered from the point of view of using the most suitable equipment now in use on the Canadian railways—equipment, which for general purposes compares very favourably with the best in use anywhere on the continent. The best of these general-purpose box-cars are known as "80,000 pound cars." Their actual axle capacity is 46 tons,[17] but it is unreasonable to suppose, in the light of the facts concerning the 1928 movement that every car would be loaded to capacity. In that year the average car-loading in respect of the western coal brought to Ontario was, on the Canadian National Railway, 37.2 tons and on the Canadian Pacific 38.7 tons.[18] Both railways used 30 and 40 ton-cars for shipments made during that season. It would probably be an exceedingly generous estimate to say that, using 40-ton cars exclusively, the average loading would be 45 tons. At that figure, however, the movement of 2,000,000 would require 44,450 car-loads to be moved

13 This type of car costs from $7,000 to $7,500 each. Vide Appendix 6, Journals of the House of Commons, 1923, pp. 243, 280.
14 Ibid. p. 175.
15 Ibid. p. 280.
16 Ibid. p. 241-42.
17 Ibid. p. 235.
18 Canadian National Railway Files.

during the 100 days, i.e., 445 each day, or say roughly 225 by each railway.

There is an idea prevalent that these 225 cars could be arbitrarily divided in four and a half trains of 50 cars each; that is, nine trains every two days, and hauled, as such, from the mines to Ontario without breaking the train. That false idea is probably based on that part of the general theory of rate making which presupposes that the proportionate cost in train loads is less than in car-loads; and similarly with car-loads and less than car-load lots.[19] It is argued in the case of the coal movement that the greatest economies of transportation can be effected by operating solid through-trains. It is only necessary to note the gross loading capacity on the various divisions on either of our railways to recognize the erroneous nature of that view when applied to traffic movements over hundreds of miles. For instance, the gross loading, i.e., the total tonnage, load and cars, that can be hauled on two of the first three main line divisions east of Edmonton is 2,000 tons for the present type of freight engine. On the division from Rivers, Manitoba, to Winnipeg it is 4,500 tons, and on the last division into Toronto it is only 1,950 tons[20]. Thus an engine which might start from the mines with a load which, if unbroken, could be hauled over any one of the main line divisions, would be operating at less than half its efficiency on others where the grades are negligible.

To be operated most economically every train sent out from a divisional point must be of such weight that the engine is working at full capacity. To start a train from the mines on either railway, therefore, which, on more than half of the divisions between Alberta and Central Canada, would utilize only two-thirds or three-quarters of the engine power would obviously be wasteful. It would be a wasteful procedure both as regards that power, and as regards the wages of trainmen and engine-men, no fewer of whom are required on a train of 1,950 tons than on one of 4,500 tons. Thus in order to haul the coal most economically a certain tonnage of other commodities would necessarily have to be hauled between certain divisional points along the route. As soon as this additional tonnage is intermittently picked up and dropped at these

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19 Principles of Railway Transportation, Ch. XXI.—Johnson and Van Metre.

20 Appendix 6, Journals of the House of Commons, 1923, p. 234; also p. 267, for similar information for Canadian Pacific Railway.

various points, there arises the impossibility of allocating to the coal movement, as such, any definite proportion of the cost. The costs of the individual movement merge, at that moment, into the costs appertaining to the movement of all commodities within the distance over which the traffic takes place, and thus becomes indistinguishable from general cost of operation in that district. Hence any rate that should be considered for the western coal must be computed, not on figures purporting to show the cost of moving a hypothetical train-load of any given tonnage a distance of two thousand miles, but as nearly as may be on the basis of the ton-mile cost as determined by experience. It appears that since the movement of coal will of necessity be inextricably bound up with the movement of general freight then the ton-mile cost of moving general freight must be the basis for calculating the rate on coal.

Probably the nearest approach that has yet been made toward arriving at a correct cost estimate was made by the Board of Railway Commissioners for Canada in 1927. At least the method used was the only logical method for dealing with the problem: that is to consider the proposed movement as indistinguishable from general traffic.

The calculations made by the representatives of the provinces of Ontario, Alberta and Saskatchewan, were based upon statistics supplied by the railways, concerning their middle western traffic for the year 1925. The statistics used by the railways' representatives were those pertaining to the traffic of 1926. Hence certain adjustments were necessary and these were made during the hearing, by the members of the Board of Railway Commissioners, in order to render the estimates comparable.

The representatives of the railways and the provinces follower accepted methods of railway accounting for subdividing expenses of operation, and used the most modern formulae and methods of computation for determining the constant and variable elements of cost. After considering all estimates and the evidence submitted in support thereof; after making certain adjustments in the estimate submitted by the representative of the provinces; and after deleting, as inapplicable, certain items in the railway estimates, the majority decision of the Board was that the out-of-pocket costs of hauling the coal were $7.22 per ton.[21]

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21 Judgments, Orders, Regulations and Rulings. Vol. XVII. No. 15 p. 448.—Board of Railway Commissioners for Canada.

That decision differed materially from any of the original estimates which were as follows :

Estimate submitted by Provincial representative $6.08 per ton
Estimate submitted by Can. National Railways $7.52 per ton
Estimate submitted by Can. Pacific Railways,
Lethbridge to Toronto ..... $7.60 per ton
Knee Hill to Toronto ..... $8.31 per ton

That the practice of establishing the actual cost of transporting a commodity that merges into the general traffic of the transportation company is fraught with the greatest difficulties and that any rate is to a certain extent only approximate is illustrated in this case. During the course of the hearing the experts representing the different interests admitted the inadequacy, at certain points, of their individual methods, and recognized the superiority of one or more of the other methods of computation in respect of the items under criticism.[22] That the whole subject is one in which personal opinion plays an important part there is no doubt. That is instanced by the fact that the group of men who have it within their power to say whether a rate is too high or too low, discriminatory or otherwise, was unable to render a unanimous opinion.

The minority report, given by Mr. Commissioner Oliver, differed radically from the majority report. In the opinion of that commissioner, no adjustments should have been made on the estimate submitted by the representative of the provinces; and although he agreed that in all probability the mathematical computations of the estimates submitted by the railways were correct, he nevertheless contended that several items included in those estimates were in no way justifiable under the order which called for the investigation. Accordingly, from those estimates he deleted and altered several items. Those changes left what he considered to be the true out-of-pocket costs, and were as follows:[23]

Provincial Representative estimate as submitted $6.08 per ton
Canadian National Railways ..... $6.03 per ton
Canadian Pacific Railways ..... $6.37 per ton

For the purpose of this monograph the official majority report should be the one to be considered as being most nearly correct, viz., $7.22 per ton. It is reasonable to suppose, however, that the estimate submitted by the expert representative of the provinces interested would be the lowest possible rate

[22] Ibid. p. 446.
[23] Ibid. p. 460.

under any circumstances. Furthermore, it was based on the supposition that the movement would necessarily occur under virtually the same conditions as outlined above[24], i.e., that the coal could never be handled exclusively in solid trains but would be intermingled with other traffic[25]. Hence if that rate be considered as the actual additional cost or expense of transporting the coal, anything above that rate should make the traffic attractive to either of the railway companies operating in Canada, on one condition, viz., that the rate to be quoted should be sufficiently in advance of the cost to pay the losses sustained by the elimination of the existing profitable traffic in Pennsylvania coal. Certainly the privately owned Canadian Pacific Railway should not be ordered to haul any commodity at cost, when by so doing they would be automatically excluding profitable traffic from another source. Similarly, the Canadian National Railways, the officers of which are making a supreme effort to make of that system a profitable organization, should not be required to haul coal at a rate which, by excluding profitable traffic now in existence, would tend only to make the task more difficult.

Although this study is concerned primarily with the lowest possible cost of a movement such as that contemplated, nevertheless the total additional cost, and the rate which would include the element of profit to the railways may here be noted. From the evidence submitted at the hearing of 1927, the Board of Railway Commissioners considered $10.07[26] the amount necessary to provide for the total inclusive costs, i.e., the proportion of all the operating expenses and fixed charges which the proposed traffic should bear. The inclusive cost plus the element of profit was estimated at $12.20.[27]

It is interesting to note here two things by way of comparison. Firstly, the tariffs in force on the railways on October 1, 1928, in respect of this traffic were as follows[28]:

	Miles	Rate per ton
Lethbridge to Toronto	1989	$12.40
Drumheller to Toronto	2107	12.70
Evansburg to Toronto	2167	13.00
Tofield to Toronto	2061	12.50
Benyon to Toronto	2107	12.70

24 Supra pp. 50, 51.
25 Judgments, Orders, Regulations and Rulings, Vol. XVII., No. 15, p. 442.—Board of Railway Commissioners for Canada.
26 Ibid. p. 450.
27 Ibid.
28 Canada Advisory Board on Tariff and Taxation. References 3 and 44. Coal and Coke, opp. p. 112.

The above rates actually in force on the railways in 1928 were only 20 cents, 30 cents, 50 cents and 80 cents per ton higher than the official estimate as to what a profitable rate should be.

Secondly, and more interesting, is the comparison of these rates with the rates on coal on the highly specialised Virginian Railway[29]. A letter signed by the Vice-President of that company was read into the evidence given before the Select Standing Committee on Mines and Minerals, 1923, in which it was stated that the rate on coal on that railway was six mills per ton mile[30]. Applying the same rate, which is admittedly a profitable one[31] to the proposed movement in Canada, the results are enlightening.

	Miles	Rate per ton @ 6 mills per ton mile
Lethbridge to Toronto	1989	$11.93
Drumheller to Toronto	2107	12.64
Evansburg to Toronto	2167	13.00
Tofield to Toronto	2061	12.36
Benyon to Toronto	2107	12.64

It will be noted that of these computed rates one only is lower than that estimated by the Board of Railway Commissioners; viz., $12.20, and that, of the others, two are only six cents below, one fourteen cents below, and the other exactly equal to the rates actually in force from the specified points to Toronto. Thus it appears that the Virginian Railway, despite its highly specialized equipment and despite the specialized nature of its traffic, does not transport coal at any appreciably lower rate than that at which the Canadian railways, using their existing, general purpose equipment, are willing to transport the western coal.

By regarding the estimate ($6.08 per ton) of the parties whose interests would be served by such a movement, i.e., the provinces, as the lowest possible out-of-pocket cost rate under existing conditions, it remains only to determine what freight rate can be paid on the coal, so that dealers may handle it in competition with the imported commodity on a profitable basis.

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29 Supra p. 43.

30 Appendix No. 6. Journals of the House of Commons, 1923, p. 185.

31 Ibid.

The average retail prices of anthracite coal in twenty-four Ontario cities for the three years ending 1927 were as follows[32]:

Year	Average Price 24 Ont. Cities	Average Price in Montreal
1925	$15.75	$16.06
1926	16.19	17.06
1927	15.54	16.09

Average price for the three years: Ontario $15.83.
Montreal 16.40.

In order to meet the competition offered by the imported commodity on the basis of quantity of heat liberated in the process of combustion (and that, after all, is the chief factor in determining a consumer's selection of coals which are presumably otherwise suitable for household use) the Alberta product would have to sell in the Ontario market at an average price of $\frac{1000}{1475} \times 15.83 = \$10.73$ a ton[33].

The conclusion that heating value, caeteris paribus, determines to a great extent the ultimate selection made by the consumers is supported by the conditions that now exist in the Manitoba market. There anthracite retails for from $16.00 to $20.00 a ton[34] according to the size of the coal. Using the method of calculation given above the Alberta household fuel would be subject to retail prices ranging from $10.80 to $13.55 a ton. Actually the prices this winter are from $10.50 to $13.75 for the more popular sizes and grades of western coal.[35]

Whether it is competition among the western operators and dealers in that district that determines the price there, or whether it is the competition arising from Pennsylvania anthracite, or the cheap, imported bituminous coal, and the coke made therefrom, is impossible to say definitely. The fact that almost none of the western coal was marketed in Winnipeg until the price of anthracite rose to nearly $20.00 a ton; and the further fact that over 80,000 tons[36] of anthracite are still marketed annually in the Head of the Lakes and Manitoba district substantiates the conclusion that the retail price of anthracite does tend to determine the price of the western household coal in that market. Furthermore, it may be noted that actual price ranges of the two coals are very

32 Coal Statistics for Canada, 1927, p. 30.
33 Supra p. 22n. For source of heat values.
34 Current Advertising, Manitoba Free Press. Winter 1928-29.
35 Ibid. Also page 43 above for total price range.
36 Coal Statistics for Canada 1927. p. 22, et seq.

nearly in the same relation to each other as the theoretical heating values of them.

The f.o.b. mine prices quoted to the retail trade in Ontario for the 1928 movement of Alberta coal were as follows[37]:

Beacon: (Mined at Coalspur, C.N.R.)	
Double Screened Lump	$5.00
Single Screened Lump	4.50
Egg	4.15
Bighorn Saunders Creek: (Mined at Saunders Creek, C.N.R.)	
Single Screened Lump	$5.25
Lethbridge Diamond: (Mined at Lethbridge, C.P.R.)	
Lump	$5.10
Sovereign: (Mined at Wayne, C.N.R.)	
Single Screened Lump	$3.75
Special Lump	4.00
Ideal: (Similar to Sovereign)	
Single Screened Lump	$3.75
Special Lump	4.00

Average f.o.b. mines price 1928 — $4.39 per ton.

The charges made by the dealers to cover expense of handling, and give a return on capital invested are, in the more populous cities where overhead costs are large, about $3.00 a ton. In the smaller towns these charges are as low as $2.50 a ton. A simple average of these is probably as approximately correct as it is possible to estimate. The large number of fuel dealers in the large centres, especially, is indicative of close competition, the factor which invariably regulates local delivery charges and retail profits. It is a logical conclusion therefore that the average indicated, viz., $2.75 could not be very materially reduced.

Of the average price of $10.73, at which it was determined that Alberta coal must be retailed in order to compete successfully with the imported coal, $7.14 ($4.39 + $2.75) would be absorbed by other than transportation charges. The remaining $3.59 per ton would be the amount which the coal traffic could bear successfully in order to put it on the market. That is less than two thirds of the minimum estimate of transportation costs as determined by the freight rate expert representing the provinces in the enquiry of 1927[38]. It is less than

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37 Wholesale Price List—Alberta and Ontario Coal Imports Limited, Toronto, Ontario, May 10, 1928.

38 Supra p. 52.

half of the estimate submitted in the majority report of the Board of Railway Commissioners.[39]

Thus after examining the facts as they actually exist, making no allowance for an exceptional decrease of the cost at the mines in the event that production could be increased by over two million tons annually; and considering no such subtle and elusive factors as national sentiment which is supposed to have the effect of making a consumer willing to pay more for a Canadian produced commodity than for a commodity of equal value produced elsewhere; considering none of these intangible and incalculable factors, the conclusion is obvious. That conclusion, applying to household fuel as well as to bituminous steam coal, was admirably summed up by a Professor of the University of Alberta, when in 1921 he was asked the question "So you think it will never be practicable for Ontario to get bituminous coal from Alberta?" He answered, "I cannot see it, I don't think it is commercially right."[40]

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[39] Supra p. 51.

[40] The Future Fuel Supply of Canada, 1921. Evidence, Professor Pitcher, Professor of Mining, University of Alberta.

CHAPTER VI.

THE EXISTING SITUATION, 1929

What, then, is the answer to Alberta's problem—the problem of an extension of the market for her coal—upon which depends much of the prosperity of her mining districts? What, also, is the answer to Central Canada's problem—the problem of a dependable supply of household fuel for her population—which, in 1923, was of such serious import as to cause prominent public men to express their apprehension in words not unlike those used by a speaker in Montreal, who, referring to the dependence of householders on the anthracite producers of the United States said: "Canada is at the mercy of the United States in regard to the coal situation. They have got us by the throat. If they choose they could freeze us to death in one winter." [1]

In the West there seems to be little opportunity for a rapid extension of the market for Alberta's household fuel. With the exception of less than 100,000 tons of anthracite used annually in the Manitoba and Head of the Lakes market, the Domestic Coal from Alberta and the lignites from Saskatchewan supply that market.

In British Columbia the abundance of coal resources seems to preclude the possibility of any great development of that market for the Alberta product. Until the present time, however, the production of coal in British Columbia has been confined to the bituminous and semi-bituminous fields. Whether the Domestic Coal of the plains can find a market in the cities of the western coast in competition with the semi-bituminous coals of Vancouver and Queen Charlotte Islands is very uncertain. Suffice it to say that, in any event, the market would not be large. The total coal consumed in the western maritime province, both industrial and household, amounts, as yet, to less than two and a half million tons annually.[2] The sub-bituminous and lignite "received from other

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1 Dr. F. D. Adams, Dean of the Faculty of Applied Science, McGill University. Quoted: House of Commons Debates, 1923, p. 1265.
2 Coal Statistics for Canada, 1927, p. 26.

provinces" (obviously Alberta) in 1923 was 85,441 tons[3], which was apparently all consumed. In 1927 the amount received was 135,036 tons of which 10,829 tons were exported[4]. Thus the Domestic Coal available for consumption was 124,207 tons—an increase of 45 per cent. in five years. Thus a small but growing market is there being opened.

That there is little hope of finding an extensive market in Montana, North Dakota or Wyoming is evident from the fact that all of those States are underlain with coal formations similar to those of Saskatchewan and Alberta[5]. There is, however, little coal in Idaho or Washington, so that a possible market exists in those states. The competition there would come chiefly from the producers of similar grades of coal in the nearby states which are so abundantly supplied.

It is significant that the Domestic Coal shipped to the United States from Alberta in 1925 was less than 17,000 tons. In 1927 shipment of almost 30,000 tons was made. The exact increase during the three years was 75.2 per cent. That the market is being developed without any governmental assistance is worthy of note, and being thus developed on sound economic principles should be maintained, and should increase steadily with the growth of population in that area.

From Alberta's standpoint it is highly desirable that the Dominion Government or the Provincial Governments of Alberta and Ontario should definitely adopt some method of subsidization or subvention, such as that applying to the 1928-30 test movement, whereby the western product may be assured of a market in the Acute Fuel Area. There is always the danger, however, in granting governmental aid to any industry, that such aid will eventually be considered as the inherent right of that industry. To quote an influential western newspaper, the opinion is expressed as follows[6]:

"Although Canada's fuel problem is difficult enough to warrant very careful study and special consideration, tariff duties and special rates once granted are apt to become part of the vested privileges of any industry, and before any further

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3 Ibid. p. 22.
4 Vide Appendix H for recent market developments.
5 Total Coal Resources; Montana 381,288 million tons; North Dakota 688,246 million tons; Wyoming 671,027 million tons.—Coal Resources of the World, 1913.
6 Manitoba Free Press. Quoted in 'Montreal Star,' Nov. 21, 1928.

concessions are made, it is only reasonable to ask that the industry concerned should do everything in its power to solve its own problem by self-help. The Alberta coal producers do not appear to have done this."

As shown in a previous chapter, the possibility, under existing circumstances, of supplying more than about one half of the household fuel for the Central Canadian market is very remote. This being the case it is fair to ask, "Would not the production of a similar amount of bituminous coal provide work for the unemployed miners and thus afford some measure of relief from the seasonal unemployment situation?" Such production would not have the effect, so much desired by the operators of the lignite and sub-bituminous coal mines, of maintaining the continuous operation of those mines. In view of the fact that, if official statements are reliable, much of the product of those mines cannot be successfully stored or banked, but must be shipped and used comparatively soon after being mined, it is doubtful whether any method of state aid would, by extending the market, maintain that operation during the spring and summer months.

It would seem that, if any form of governmental assistance is to be applied to aid the Alberta producers, especially for the sake of the workers, it should be applied to the bituminous coal industry, in an endeavour to drive the imported product from the Manitoba and Head of the Lakes market. The total annual bituminous coal consumption in that area now averages more than one and a half million tons[7]. Of that only about 5 per cent. is supplied by Alberta. Thus if any subsidy is necessary, a relatively small one would aid the bituminous miners in forcing an entry into that market—relatively small, that is, when compared with the aid required to place the Domestic Coal on the Ontario market.

In 1928, for example, the price, f.o.b. Winnipeg, quoted by one of the bituminous coal operators of the West[8] on a 50,000 ton contract was $9.55 a ton. An American firm filled the order for $3.99 a ton f.o.b. cars at Fort William[9]. To that must be added 50 cents a ton duty and $3.30 a ton freight to Winnipeg, making the price, at point of consumption, $7.79. The difference of $1.76 in the two quotations is accounted for

7 Coal Statistics for Canada, 1927. p. 22 et seq.
8 Advisory Board on Tariff and Taxation. Coal and Coke, 1928. p. 152 et seq.
9 Ibid.

for principally by the cost at the mine. The average price at the mine of all bituminous coal imported into Canada in 1927 was $2.10 a ton[10]. The average price per ton at the mine of bituminous coal in Alberta in the same year was $3.64.[11] The difference of $1.54 in the average costs at the mines, therefore, accounts for 87.5 per cent. of the difference in the quotations in the particular instance.

Hence, a subsidy of less than $1.75 a ton paid directly to the bituminous operators of the West, should be sufficient to enable them to drive their competitor from the Winnipeg market at least, without compelling the transportation companies to carry any coal at a profitless rate. Compare that figure with the $2.80, or more, necessary to subsidize the Domestic Coal to the extent of paying the lowest estimate of bare, out-of-pocket, transportation costs and, if the desirableness from either an economic or national viewpoint of any system of governmental aid be admitted, the efficacy of this scheme from the viewpoint of the tax-payer becomes apparent. It would not only mean a lesser drain on the national exchequer, but it would allow all parties concerned to make a fair return on capital investment. Although it would not provide quite as large a market as the possible 2,000,000-ton household fuel market in the east, it would nevertheless go far toward providing steady work for the mine workers.

What may be done in the future toward the successful processing of some of the coals of the western plains is impossible to forecast. In 1928 after several years of experimenting a successful attempt at low-temperature distillation was reported at Drumheller. The following excerpt from the newspaper[12] which reported the results is interesting. It said, in part:

"The heat value of one ton of char briquets (the product of the experiment) is 2.24 times as much as one ton of anthracite coal, while one ton of the char briquets is the same in volume as two tons of coal.

"If this were applied to the Ontario market the figures are illuminating:

"Two tons of anthracite would be $30.00.

"One ton of char briquets is intended to sell at $25.00.

"The char can be briquetted with the greatest of ease and in a manner which will prevent the deterioration in transportation or loss of heat efficiency."

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10 Vide Canada Year Book, 1927. p. 383.
11 Coal Statistics for Canada, 1927, p. 29.
12 Calgary Albertan, March 6, 1928.

The whole process is yet in the experimental stage. In order to be free from American competition, however, it must be a process which is not applicable to the bituminous class coals of the United States. If it, or a similar process can be Domestic Coal producers as at present obtains for the bituapplied to those coals the result would be the same for the minous coal producers in respect of coke; viz., competition which could not be met.

In Central Canada the situation has changed materially since the early post-war years. The whole trend seems to be toward the use of substitutes for the Pennsylvania anthracite, and tends to a certain extent to prove the statement made in 1926 by an eminent fuel engineer, that ultimately the competition which Canadian coal would have to meet in that market would not be the high-priced anthracite from the United States[13]. It would be the low-priced "smokeless" or low-volatile coals of West Virginia, or the ordinary bituminous coals in some prepared form. At the present time (1929) those coals can be delivered f.o.b. Ontario cities at prices ranging from $6.00 to $8.00 a ton, all duty and freight charges paid, as compared with nearly double those prices for anthracite.

In 1921, Pennsylvania anthracite importations to Canada were over five million tons[14]. The smallest amount imported since the abnormal year of 1923 was in 1926 when only three and a third million tons entered. Obviously the actual consumption of fuel for other than industrial purposes would not have decreased, but would on the other hand have tended to increase. The difference must be accounted for by the growing demand for substitutes.

Anthracite from Great Britain accounts for part of the decrease. In 1922 no household coal was imported from there. In 1927 more than three-quarters of a million tons came to the Lower St. Lawrence Valley, chiefly to the port of Montreal. When it is considered that the ocean rate on coal from Great Britain is from $1.50 to $2.50 a ton[15], while the freight rate from Scranton, Pa., to Montreal is over $4.00[16] there is every reason to believe that eventually the coal from the British Isles may capture to a large extent the household coal market of the province of Quebec. In that event, Montreal would merely shift its dependence for fuel from the coal mines

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13 Jour. of the Engineering Institute of Canada. Vol. 9. p. 67.
14 Fig. 2. opp. p. 13.
15 Advisory Board of Tariff and Taxation, 1928. Coal and Coke. opp. p. 112.
16 Ibid.

of Pennsylvania, 400 miles away, to those of Great Britain which are distant 2,800 miles—a rather doubtful advantage except in as far as it provides cheaper coal at the moment.

The greatest change, however, is noticeable in the increased use of the American sub-bituminous and bituminous coals and of the prepared product therefrom, viz., coke. Of the first, the use of 190,000 tons in 1923 increased to 500,000 tons in 1927[17]. Of the second, churches, schools and apartments, which used to be heated almost entirely by anthracite, now use a million tons annually[18]. Of the third, the consumption in Ontario and Quebec for other than industrial purposes grew from 270,000 to 1,000,000 tons in the same period.[19]

These actual changes of the past few years have greatly lessened the dependence on the anthracite mines of the United States. True, the source of the substitute fuels lies beyond the borders of Canada. True, the Canadian consumer has no control over that supply. But what matter? Prolonged periods of industrial strife little affect the supply of bituminous coal destined to be consumed in Canada. Witness the strike in the bituminous coal-fields in 1927. It affected more than 170,000 workers in the states of Illinois, Indiana, Ohio and western Pennsylvania. It lasted from April to October, and in the case of the last two states was not then ended.[20] Yet, in spite of that, Canada imported more bituminous coal in that year than in either 1925 or 1926. There is no danger of the United States Government imposing an embargo on bituminous coal for a great many years to come. Instead there is a growing tendency to seek new markets even farther afield. On the whole, therefore, there is now little cause for alarm.

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17 Changes in the Fuel Situation in Canada.—C. Camsell, Chairman of the Dominion Fuel Board.
18 Ibid.
19 Ibid.
20 Report of the Interstate Commerce Commission, 1927. p. 37.

NOTE

This monograph was written early in 1929, but inasmuch as the main factors in the situation have not been altered since then, the author has not thought it necessary to add to it.

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38. Filed material in reference to the history of the movement of western coal to Ontario. (This material was made available through the courtesy of the Canadian National Railways, to whom acknowledgment is here made).

APPENDIX A.

Summary of Estimate of Coal Resources of Canada[1].

Group I.

Including Seams of 1 Foot or over, to a Depth of 4,000 Feet.

District	Actual Reserve (Calculation based on actual thickness and extent)			Probable Reserves (Approximate Estimate)		
	Area square miles	Class of Coal	Thousands of Metric tons	Area square miles	Class of Coal	Thousands of Metric tons
Nova Scotia	174.31	B^2	2,137,736	273.5	B^2	4,871,817
		C	50,415		C	20,000
New Brunswick				121.0	B^2	151,000
Ontario				10.0	D^2	25,000
Manitoba				48.0	D^2	160,000
Saskatchewan	306.0	D^2	2,412,000	13,100.0	D^2	57,400,000
Alberta	25,300.0	D^2		56,375.0	D^2	26,450,000
		D^1	382,500,000		D^1	464,821,000
		B^3	1,197,000		B^3	139,161,000
		B^2 B^1	2,026,800		B^2 B^1	43,022,600
		A^2	669,000		A^2	100,000
British Columbia	439.0	A^2 B^2	23,653,242	5,595.0	A^2 B^2	40,807,700
		B^3	118,000		B^3	2,300,000
		D^2	60,000		D^1 D^2	5,136,000
					C	1,800,000
Yukon				2,840.0	A^2 B^3	250,000
					D^1 D^2	4,690,000
North West Territories				300.0	D^2	4,800,000
Arctic Islands				6,000.0	B^2 B^3 C	6,000,000
Totals	26,219.31		414,804,193	82,662.5		801,966,117

1 From: Geological Survey of Canada. Memoir 59.

2 In this total 20,000,000 has been deducted for the amount of coal of all classes already extracted in Alberta.

APPENDIX A (Continued)

Summary of Estimate of Coal Resources of Canada[1]

Group II.

Including Seams of 2 Feet and Over at Depths Between 4,000 and 6,000 Feet

District	Probable Reserves (Approximate Estimate) Area square miles	Class of Coal	Thousands of Metric tons
Nova Scotia (marine areas, 3 to 5 mile limit)	73	B[2]	2,639,000
Alberta	203	B[2]	12,700,000
British Columbia	11	B[2]	2,160,000
Totals	287		17,499,000

1 From: Geological Survey of Canada. Memoir 59.
2 In this total 20,000,000 has been deducted for the amount of coal of all classes already extracted in Alberta.

APPENDIX B.

Table to Show the Production of Coal in Alberta 1912 - 1927[1]

Year	Tons	Year	Tons
1912	3,240,577	1920	6,907,765
1913	4,014,755	1921	5,909,217
1914	3,683,015	1922	5,990,911
1915	3,360,818	1923	6,854,397
1916	4,559,054	1924	5,189,729
1917	4,736,368	1925	5,869,031
1918	5,972,816	1926	6,503,705
1919	4,933,660	1927	6,934,162

1 Coal Statistics for Canada, 1927. p. 68.

8 7336,
9 7151
30 5756
31 4574

APPENDIX C.

Table to Show the Growth of Coal Consumption in Canada

Period	Total Consumption Tons	Annual Average Tons
1872-1879 (1)	12,068,595	1,508,574
1880-1887 (1)	24,772,832	3,096,604
1888-1897 (2)	54,652,410	5,465,241
1898-1907 (2)	116,562,937	11,656,294
1908-1917 (2)	255,460,979	25,546,098
1918-1926 (3)	279,049,319	31,005,479

1 Canada Statistical Record 1894.
2 Canada Year Book, 1921.
3 Canada Year Book, 1927-28.

APPENDIX D.

Table to Show the Growth of Production of Coal in Canada by Provinces

Period	Nova Scotia	Br. Columbia	Alberta	Sask.	Yukon	New Bruns.	Total Tons(3)	Annual Average
1874-77 [1]	3,621,531	513,611					4,135,148	1,033,787
1878-87 [1]	14,551,922	3,275,078				10,040	17,837,040	1,783,704
1888-97 [1]	22,669,583	9,298,799				66,372	32,034,854	3,203,485
1898-1907 [1]	48,125,722	18,210,361	5,982,025	764,714	41,623	186,285	73,310,730	7,331,073
1908-17 [2]	69,577,676	26,059,890	31,680,494	2,278,006	90,542	893,431	130,580,039	13,058,004
1918-27 [2]	59,055,305	26,788,719	61,043,053	4,093,839	8,355	2,162,767	153,152,038	15,315,204

1 Computed from Statistics in Canada Year Book 1911 p. 419.

2 Computed from Statistics in Canada Year Book 1927-28 p. 382.

3 NOTE: These totals do not all agree with the figures, if added, as given in the corresponding column in the Canada Year Book. In the years 1880 and 1921 there are obvious errors in totalling. In the years 1886 to 1899 inclusive there are annual averages in the totals in the official publication. Presumably those averages are amounts mined in the North-West territories, but which are not allocated. They are, for the years indicated: 43,220; 74,552; 115,124; 97,364; 128,953; 174,131; 184,370; 238,395; 199,991; 185,654; 225,868; 267,163; 340,088; and 334,600 tons respectively.

APPENDIX E.

Table to Show the Importation of Coal into Canada, 1868 - 1927

Period	Anthracite and Lignite	Bituminous	Total Tons	Annual Average
1868-77 [1]	5,237,024	513,970	5,750,994	575.099
1878-87 [1]	7,179,293	6,732,714	13,912,007	1,391,201
1888-97 [1]	14,976,904	14,592,687	29,569,591	2,956,959
1898-1907 [1]	18,997,873	31,903,679	50,901,552	5,090,155
1908-17 [2]	38,896,015	96,168,806	135,064,821	13,564,821
1918-27 [2]	44,200,891	138,453,414	182,654,305	18,265,431

[1] Computed from Statistics in Canada Year Book, 1911.
[2] Computed from Statistics in Canada Year Book 1927-28.

APPENDIX F.

Table to Show the Coal Exported from Canada, 1868 - 1927

Period	Total Tons	Annual Average
1868-77 [1]	3,244,817	324,481
1878-87 [1]	4,237,917	423,797
1888-97 [1]	8,844,953	884,495
1897-1907 [1]	15,916,710	1,591,671
1908-17 [2]	18,068,025	1,806,503
1918-27 [2]	16,126,560	1,612,656

[1] Computed from Statistics in Canada Year Book, 1911.
[2] Computed from Statistics in Canada Year Book 1927-28.

APPENDIX F.F.

Sales in District between Winnipeg and Moose Jaw[1]

Year	American Anthracite Tons	Price f.o.b. Winnipeg	Canadian Anthracite Tons	Price f.o.b. Winnipeg	Percentage of Alberta fuel to total
1892	25000	$10.00	1500	$ 9.50	5.6
1893	27000	10-12.25	4000	8.25	12.9
1894	18300	8.25	11000	8.00	37.5
1895	17700	8.00	11000	8.00	38.3
1896	24000	9.50	12000	9.00	33.3
1897	24000	9.50	12000	9.00	33.3
1898	24000	7.50	5500	6.75	18.6
1899	31000	7.25	8500	6.75	21.5
1900	32700	9.50	11000	9.00	25.2
1901	37500	9.50	6500	9.00	14.8
1902	39500	10.00	500	9.50	1.3
1903	24000	13.00	none		
1904	48000		none		
1905	54000	11.00	2000	10.50	3.6
1905-6	58000	11.00	8000	10.50	10.9
1906-7	115000	11.00	40000	10.00	25.8
1907-8	140000	10.50	40000	10.00	22.2

[1] This Table is compiled from information derived from Sessional Papers 1893-1907. Reports of the Interior.

APPENDIX G.

Table which shows the Results of 3-hour Tumbling Tests on Unweathered Fuels in current use in Canada[1].

	Fuel Used	Weight of Sample Grammes	Summary of Screen Analyses "Lumps" on 0.742" Screen %	"Smalls" on 0.164" Screen (35 mesh) %	"Fines" on 0.0029" Screen (200 mesh) %	"Dust" through a 200 mesh Screen %
	1½" to 2" size					
1.	Pennsylvania Bituminous	1200	64.6	4.3	31.1	
2.	New Brunswick, Minto Bituminous	1200	51.8	8.1	40.1	
3.	Alberta, Saunders, Sub-bituminous	1200	60.6	7.1	32.3	
4.	Alberta, Taber, Lignite	1200	55.7	14.9	17.2	12.2
5.	Alberta, Drumheller, Lignite	1200	80.	2.8	17.2	
6.	Alberta, Drumheller, Lignite	1200	74.8	8.2	9.7	7.3
7.	Alberta, Pembina, Lignite	1200	58.1	16.5	16.2	9.2
8.	Alberta, Cardiff, Lignite	1200	66.3	11.9	14.8	7.0
	1" to 1½" size					
9.	Pennsylvania, semi-bituminous	1200	35.3	13.0	29.8	21.9
10.	Alberta, Canmore, semi-bituminous	1200	49.4	9.9	20.4	20.3
11.	Pennsylvania, bituminous	1200	63.9	8.1	28.0	
12.	New Brunswick, Minto, bituminous	1200	48.1	20.8	31.1	
13.	Alberta, Coalspur, sub-bituminous	1200	67.1	10.9	12.2	9.8
14.	Alberta, Saunders, sub-bituminous	1200	62.9	13.3	12.2	11.6
15.	Alberta, Saunders, sub-bituminous	1200	58.5	16.5	25.0	
16.	Alberta, Taber, Lignite	1200	63.6	15.0	8.9	12.5
17.	Alberta, Drumheller, Lignite	1200	73.5	13.5	4.8	8.2
18.	Alberta, Drumheller, Lignite	1200	74.8	11.8	13.4	
19.	Alberta, Drumheller, Lignite	1200	74.6	11.3	6.7	7.4
20.	Alberta, Pembina, Lignite	1200	51.2	25.6	12.2	11.0
21.	Alberta, Cardiff, Lignite	1200	58.5	22.0	13.0	6.5
	½" to 1" size					
22.	Pennsylvania, bituminous	1200	45.6	32.5	21.9	
23.	Alberta, Saunders, sub-bituminous	1200	30.4	50.1	19.5	
24.	Alberta, Drumheller, Lignite	1200	51.5	39.2	9.3	

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1 From Canada Department of Mines. Summary Reports 1924. "Fuels and Fuel Testing."

2 Division between "Smalls" and "Fines" at 0.0065; dust not determined.

APPENDIX H.[1]

Table to Show the Expanding Coal Trade of Alberta

(Thousands of Tons)

Bituminous

Destination	1925	1926	1927	Percentage Change Since 1925 Gain	Loss
Alberta	93.8	80.2	116.1	23.6	
Saskatchewan	55.4	66.5	86.9	55.1	
B. Columbia	34.3	34.9	51.3	50.	
Manitoba	18.3	62.7	80.3	344.4	
United States	32.7	26.1	16.3		50.1
Railroads	1819.3	2468.1	2466.2	35.5	

Domestic Coals

Alberta	1314.8	1188.7	1331.2	1.2	
Saskatchewan	1243.2	1229.1	1346.6	8.3	
B. Columbia	83.5	93.8	134.9	61.5	
Manitoba	493.2	528.6	531.0	7.7	
United States	16.9	21.8	29.6	75.2	
Railways	284.0	246.7	296.3	4.3	

[1] Arranged from Statistics given in "Coal Statistics for Canada" 1926, pp. 87, 88; and ibid 1927, pp. 75, 76.

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